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# FINAL REPORT

# ILIR INVESTIGATION

# OF

# COMPATIBILITY OF SILICONE-BASED BRAKE FLUIDS WITH ELASTOMERIC COMPONENTS OF ARMY VEHICLES AND WEAPON SYSTEMS





OCTOBER 1980

[redacted]



US ARMY ABERDEEN PROVING GROUND
ABERDEEN PROVING GROUND, MARYLAND
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
An investigation was conducted to determine the compatibility of recently specified silicone brake fluids with elastomers expected to be found in developmental vehicles submitted to US Army Aberdeen Proving Ground for tests and to compare their performance with conventional fluids. More than 1500 immersion tests were conducted at temperatures ranging from -18 to +120° C (0 to 248° F) with 14 different elastomers and 5 different brake fluids. It was found that the silicone brake fluids performed as well as/or better than the conventional fluid in all tests involving vehicle brake system elastomers.

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20. Extended periods of exposure did not reveal any deficiencies. Brake performance of systems in which silicone brake fluids and conventional brake fluid become inadvertently mixed will operate normally with no fluid/elastomer related problems. Contaminants such as petroleum based fluids will cause undesirable attacks on brake system elastomers regardless of the fluid in the system.

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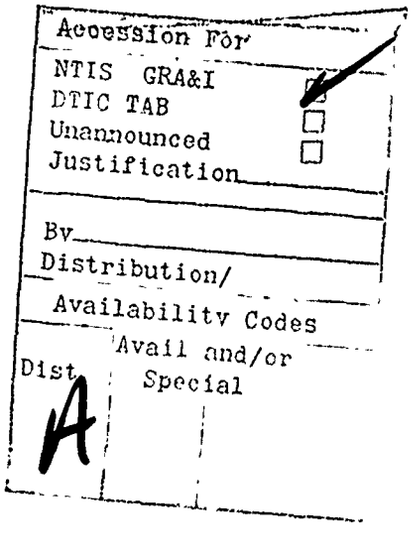






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FOREWORD

This work was accomplished under the Army's In-House Laboratory Independent Research (ILIR) Program, TECOM Project No. 7-CO-IL8-AP1-001, Task 02.

Acknowledgement is extended to SP4 Linda Maillet for her assistance in the accumulation of laboratory data included in this report and to Mr. M. Drabo for his guidance in the performance of the investigation and editorial assistance in presentation of the results.



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## SECTION 1. INTRODUCTION

### 1.1 BACKGROUND

The US Army initiated research on silicone brake fluids in 1967. Satisfactory completion of a large number of laboratory and field tests (reported in ref 2 and 3) showed that the silicone fluids possessed many desirable physical and chemical properties with respect to power transmission in brake systems. Subsequently a specification was published (ref 4) which is expected to replace three existing military brake fluid specifications (ref 5, 6, 7).

Military vehicle developers, test engineers, automotive manufacturers, and the Society of Automotive Engineers identified an area of basic study which should be accomplished before the new technology could be fully accepted. This area of concern involved the compatibility of silicone brake fluids with the elastomers which are found in various vehicle systems. In order to resolve these concerns and to corroborate the validity of basic laboratory and field tests, an in-depth study of silicone fluid/elastomer compatibility was authorized by the Department of the Army's In-House Laboratory Independent Research Program. Findings from this study will be applied to analysis of failures occurring in production, and in experimental and developmental vehicles undergoing tests at Army test sites. Results of the investigation will aid brake system design engineers and brake fluid manufacturers in their evaluation of the performance of the new silicone brake fluids.

### 1.2 OBJECTIVES

a. To identify possible problem areas involving compatibility of silicone fluids with the many elastomers which are found in military vehicular and weapons systems.

b. To investigate the effect of silicone and conventional brake fluid mixtures on elastomers found in vehicular brake systems; to investigate the effect of silicone brake fluid contaminants on automotive brake systems elastomers.

### 1.3 SUMMARY OF INVESTIGATION

More than 1500 comparative immersion tests were conducted at temperatures ranging from -18 to 120° C (0 to 248° F) with 14 different elastomers and 5 different brake fluids. Test Report APG-MT-5351, dated February 1980 (ref 8) outlined preliminary findings. This report contains the summary of all findings included in the study. The silicone brake fluid performed as well or better than conventional fluid in all tests involving vehicle brake system elastomers. Tests on mixtures of conventional and silicone brake fluids did not reveal any serious deficiencies which would lead to brake malfunction.

## 1.4 CONCLUSIONS

It is concluded that:

a. The use of silicone brake fluids in the brake systems of military vehicles will not adversely affect brake performance from the standpoint of fluid/elastomer compatibility (para 2.1, 2.2, and 2.3).

b. Brake performance of systems in which silicone brake fluid and conventional brake fluid become inadvertantly mixed will operate normally with no fluid/elastomer related problems (para 2.2d, 2.2g).

c. Contaminants in silicone brake fluids such as engine oils, petroleum base hydraulic fluids, shock absorber fluids, etc., will cause undesirable attack on brake system elastomers, which will lead to brake failures (para 2.2f).

d. The same class of contaminants (conclusion c) in conventional fluids will also cause brake failures (para 2.2f).

## 1.5 RECOMMENDATIONS

It is recommended that silicone brake fluid be placed in military vehicle brake systems at the earliest possible date.

## 1.6 INTERPRETATION OF ACCOMPLISHMENTS

The weight of laboratory and field performance data generated by the Army (ref 2 and 3) substantiates the proposed changeover from polyglycol brake fluids to silicone brake fluids. The references show conclusively that the advantages of silicone fluids are significant. The present ILIR study (para 2.1, 2.2, 2.3) shows that previously questioned areas of silicone brake fluid/elastomer compatibility and effect of silicone/conventional brake fluid mixtures on elastomers do not pose a problem in brake performance. There appears to be no valid technical reason to preclude the entry of silicone brake fluid into the Army inventory.

## SECTION 2. DETAILS OF INVESTIGATION

### 2.1 MATERIALS TESTED

Tests reported herein were conducted on representative silicone brake fluids listed in table 2-1. SAE brake fluid RM 66-03, a conventional polyglycol fluid, was used for comparison purposes. Fourteen automotive elastomers were used in the study (table 2-2).

TABLE 2-1. FLUIDS

| Fluids | Type |
|---|---|
| Code A | Silicone |
| Code B | Silicone |
| Code C | Silicone |
| SAE RM 70 | Silicone |
| SAE RM 66-03 | Conventional polyglycol |

TABLE 2-2. ELASTOMERS

| Elastomer Type | Use | Shore "A" Durometer Hardness |
|---|---|---|
| SBR (Styrene butadiene rubber) | Wheel cylinder cups | 50 |
| SBR | Master cylinder seals | 70 |
| SBR (SAE) | Disk brake seals | 70 |
| EPDM (ethylene propylene rubber) | Disk brake seals | 70 |
| EPDM | Brake valve parts and seals | 80 |
| EPDM (SAE RM 69) | Referee test slabs | 70 |
| Viton | O-rings | 70 |
| Silicone rubber | Seals and O-rings | 60 |
| NR (natural rubber based on SAE-ISO-1) | Referee test slab | 60 |
| BUNA-N, 33% ACN (nitrile rubber) | Automotive parts | 60 |
| BUNA-N, 21% ACN | Automotive parts | 70 |
| BUNA-N, 41% ACN | Automotive parts | 70 |
| Neoprene (SAE RM 68) | Brake hose | 70 to 80 |
| Chlorobutyl rubber | Master cylinder diaphragms | 60 |

## 2.2 IMMERSION TESTS

Eleven series of immersion tests were conducted during the investigation. One-inch slabs of each of the elastomers were washed with isopropyl alcohol and weighed in air and water. The hardness was determined using a Shore "D" durometer. Test slabs were immersed in each of the fluids (in duplicate) under the following conditions:

a. Test No. 1. This test was conducted at ambient conditions. Test jars were stored on the laboratory shelf. Rubber specimens were removed after 1 week, 3 weeks, 2 months, 6 months, and 12 months; the specimens were wiped with a clean lint-free cloth, weighed in air and water to determine change in volume, and the hardness was measured. After each storage period the specimens were examined for evidence of disintegration and then placed back in the test jar.

b. Test No. 2. This test was conducted at 70° C (158° F). Rubber specimens were removed after 3 days and 7 days. Test jars were removed from the oven and allowed to cool for 30 minutes. The rubber specimens were then removed, wiped with a clean cloth, weighed in air and water to determine volume, and the hardness was determined; the specimens were examined for disintegration, and after the three day inspection placed back in the test jar; jars were placed back in the oven; after the 7-day inspection the fluids were visually examined for excessive sediment buildup.

c. Test No. 3. This test was identical to Test No. 2 (para 2.2b) except that the test temperature was 120° C (248° F). Rubber specimens were examined after 3 days and 7 days.

d. Test No. 4. In this test each of the silicone fluids was mixed with an equal quantity of the conventional fluid and placed in the test jars. The two fluids were not miscible so they separated. The volume and hardness of two rubber test specimens was determined. One specimen was placed in the lower fluid layer (conventional fluid), and one specimen was suspended horizontally in the top fluid layer (silicone). The jar was stored on the laboratory shelf at ambient temperature. The volume and hardness of each of the two rubber test specimens was measured and examined after 2 weeks, 8 weeks, 6 months, and 1 year.

e. Test No. 5. This test was conducted at -18° C (0° F). Test jars were removed from the cold chamber after 2 weeks, 8 weeks, 6 months, and 1 year. The volume and hardness of rubber specimens was measured within 10 minutes after the jars were taken from the chamber, after which the specimens were examined for evidence of disintegration and then placed back in the test jars. Exposure to cold temperature continued until the end of the test.

2.2 (Cont'd)

f. Tests No. 6, 6A, 7, 7A, and 8. These tests were run on the silicone compatibility fluid and the conventional fluid in order to determine the effect of some common automotive contaminants on the performance of the rubber. In tests No. 6 and 6A, 1% and 5% respectively, by volume of petroleum oil conforming to grade 10, MIL-L-2104 (ref 9) was added to each of the jars. In tests 7 and 7A, 1% and 5% respectively, of synthetic lubricant meeting MIL-L-46167 (ref 10) was added to each of the jars. In test 8, 10% of hydraulic fluid meeting MIL-H-6083 (ref 11) was added to each of the jars. Each of these tests was stored at ambient temperature and examined after 1 week, 3 weeks, 7 weeks, 6 months, and 1 year.

g. Test No. 9. In this test, conventional fluid was mixed with the silicone compatibility fluid to produce conventional fluid concentrations of 5%, 10%, 20%, and 30% by volume. Rubber specimens were immersed as described in test No. 4 (para 2.2d). Four, eight, 26 weeks, and 1 year examinations were made.

h. Test No. 10. This test was run on neoprene rubber at 100° C (212° F) in order to correlate with the test temperature prescribed for neoprene in silicone brake fluid specifications. Specimens were examined after 3 days and 7 days exposure.

i. Tests No. 11 and 11A. These tests were conducted with each of the fluids contaminated with 3.5% water. Test 11 was run at 70° C (158° F). Test 11A was run at 120° C (248° F). In each of these tests, specimens of neoprene, SBR (70 duro), EPDM (SAE RM 69) and natural rubber were suspended in the fluid/water mixture and inspected after 3 days and 7 days exposure.

j. Test No. 12. In this test, rubber specimens were soaked in conventional fluid for 3 days at 70° C (158° F). After 3 days the test slabs were removed from the fluid, rinsed in isopropyl alcohol and wiped with a clean, lint free cloth. Hardness and volume measurements were taken. The slabs were then immersed in the silicone fluids for 7 days at 70° C (158° F), removed, wiped with a clean lint-free cloth, and change in hardness and volume was measured.

k. Comparison criteria. The criteria listed in table 2-3 were established in reference 4 to check performance of silicone brake fluids on some elastomers found in vehicle brake systems. These criteria were used as a basis for comparing the performance of the fluid/elastomer combinations in these tests with known satisfactory performance levels.

TABLE 2-3. CRITERIA FOR RUBBER PERFORMANCE
(REFERENCE 4)

| Type of Rubber | Immersion Tests: Volume Swell (percent) | Changes In Hardness (Durometer points) | Test Temp °C | Test Temp °F |
|---|---|---|---|---|
| SBR | +5 to +20 | 0 to -10 | 70 ± 2 | 158 ± 3 |
| | +5 to +20 | 0 to -15 | 120 ± 2 | 248 ± 3 |
| Neoprene | -3 to + 6 | +3 to -10 | 70 ± 2 | 158 ± 3 |
| | -3 to +10 | +3 to -10 | 100 ± 2 | 212 ± 3 |
| EP | 0 to +16 | 0 to -10 | 70 ± 2 | 158 ± 3 |
| Natural | +5 to +20 | 0 to -10 | 70 ± 2 | 158 ± 3 |

## 2.3 RESULTS AND ANALYSIS

a. Results. Results of all tests conducted in this program are tabulated in appendix A. These tables include all tests reported in Partial Report APG-MT-5351 (ref 8) plus all tests completed after those reported in reference 8.

b. Effect on SBR.

(1) Results. No significant changes in results were evident in tests involving prolonged storage. In tests No. 11 and 11A the silicone fluids performed satisfactorily. The conventional fluid gave borderline low results. Test No. 12 showed no problems with SBR.

(2) Analysis. The analysis of SBR performance outlined in reference 8 is accurate. The additional tests included in this report did not reveal any unsatisfactory performance which would cause brake system malfunction.

c. Effect on Neoprene Rubber.

(1) Results. After 1 year's storage three of the silicone fluids and the conventional fluid gave high swelling values at ambient temperatures. These high values also were evident in tests involving 5% and 10% mixtures of conventional fluid in the silicone fluids. Larger percentages of conventional fluid in the silicone fluids lowered the swelling into the satisfactory range. The swelling at 100° C (212° F) followed the pattern previously reported for tests at 120° C (248° F). The pressure of water caused high neoprene swelling in one of the silicone fluids and the conventional fluid; one silicone fluid was borderline low.

(2) Analysis. Swelling values on neoprene rubber beyond recommended criteria were found in many instances in the silicone fluids and conventional fluids. Based on past satisfactory performance of the conventional fluid, even though swelling occurs, it would appear that

2.3 (Cont'd)

the silicone fluids would also perform satisfactorily. Performance criteria should be examined by rubber technologists and altered to reflect the above findings. Requirements could be relaxed since swelling/shrinkage values are not as critical for neoprene as those for rubber parts which move during braking applications.

d. Effect on EP Rubber.

(1) Results. Borderline low values were received with EP/conventional fluid at ambient and -18° C (0° F) temperatures. Silicone fluids performed satisfactorily with EP rubber at all temperatures.

(2) Analysis. No problems would be expected in the use of silicone brake fluids with EP rubber. The amount of shrinkage found with the conventional fluid would not be expected to cause poor performance; recent research has been directed toward improving the cold-temperature properties of EP rubber.

e. Effect on Natural Rubber.

(1) Results. Temperatures of 120° C (248° F) caused NR to soften in the presence of the silicone compatibility fluid; other silicones performed satisfactorily at all temperatures. The conventional fluid gave low swelling values on NR in most tests.

(2) Analysis. In the present study, the performance of silicone brake fluids on natural rubber was superior to the performance of conventional brake fluids. No problems would be expected if silicone fluids were used in brake systems containing NR (primarily foreign vehicles).

f. Effect on Butyl Rubber.

(1) Results. Neither the silicone fluids nor the conventional brake fluid had much effect on butyl rubber in any of the tests conducted; there was very little shrinkage or swelling.

(2) Analysis. There would be no operational difficulties related to butyl rubber if silicone brake fluids replaced conventional brake fluids in vehicle brake systems.

g. Effect on Nitrile Rubber.

(1) Results. Extended storage did not vary the results of the study on nitrile rubber. Except in isolated instances the silicone fluids were compatible with the nitrile rubber formulations. Conventional brake fluid is not compatible.

2.3 (Cont'd)

(2) Analysis. Nitrile rubber is compatible with petroleum base fluids but incompatible with non-petroleum base fluids such as the polyglycol brake fluids. The degree of compatibility of nitrile rubber with silicone fluids could point out possible areas of development involving these two materials in both vehicle systems and weapons recoil systems.

h. Mixed fluids.

(1) Results. Tests 9 and 4 which were run on conventional fluid/silicone fluid mixtures (5/95, 10/90, 20/80, 30/70, 50/50, respectively) showed that quite often swelling of the elastomers was of different magnitude in each fluid. The differences in swelling caused by the two fluids were all relatively small and showed up gradually over a long period of time. After a 1-year storage period, the largest distortion (difference in swelling) in mixtures of silicone fluids meeting MIL-B-46176 and the conventional fluids was 0.8% on SBR, 4.3% on EP rubber, 6..% on natural rubber, and 1.6% on neoprene.

(2) Analysis. When immiscible, silicone brake fluids and conventional brake fluids are mixed, rubber conditioning additives migrate from one fluid to the other and contribute to uneven swelling of rubber components which are exposed to both fluids. This study has shown that brake system elastomer distortion is not extreme; the resultant effect of the distortion is gradual and would not contribute to catastrophic brake failure.

i. Effect of contaminants.

(1) Results. Extended storage periods emphasized the incompatibility of brake system elastomers with petroleum base fluids which were added as contaminants to the silicone and conventional brake fluids. In the tests involving water as a contaminant, natural rubber and SBR showed decreased swelling in the conventional fluid; neoprene showed higher swelling values in the conventional fluid and the silicone compatibility fluid.

(2) Analysis. Petroleum base fluids are the most consistent contaminants found in vehicle brake systems. Many brake failures have been documented as directly attributed to this type of contamination. Changing from the conventional fluid to silicone fluid will not alleviate the problem. Early studies showed that water contamination affect the rubber swelling properties of conventional brake fluids. This stud, shows that water contamination does not affect the silicone fluid/elastomer compatibility to the extent that it affects conventional fluid/elastomer compatibility. Also, water contamination of silicone fluids is less likely to occur due to the hydrophobic properties of the silicone fluids.

2.3 (Cont'd)

j. Effect on Viton Rubber.

(1) Results. Viton was compatible with silicone fluids, Codes A and B, but was not compatible with silicone fluid Code C, the silicone compatibility fluid, or the conventional fluid. Extended storage did not alter preliminary findings.

(2) Analysis. Viton rubber is not used in brake systems, but has other automotive applications. The compatibility of Viton with some of the silicone fluids is noteworthy, and might be of interest to design engineers in developmental work in the automotive field.

k. Effect on Silicone Rubber.

(1) Results. Silicone rubber does not swell or soften excessively in conventional brake fluids. It is not compatible with silicone brake fluids due to extreme swelling, softening, and disintegration.

(2) Analysis. Silicone rubber is chemically similar to silicone brake fluids and is not compatible with the silicone fluids due to the solution effect. The silicone rubber can be used in automotive applications such as radiator hoses, O-rings, or other applications where it is exposed to polar type fluids.

ℓ. Effect of presoaking in conventional brake fluids.

(1) Results. In Test No. 12, in which the rubber test specimens were first exposed to conventional brake fluids, then exposed to silicone, no degradation, excessive swelling, or excessive softening of the brake system elastomers was found.

(2) Analysis. In the recommended changeover from conventional brake fluids to silicone brake fluids, a question was raised of the effect that pre-exposure of elastomers to conventional fluids would have on silicone fluid compatibility. Test 12 was devised to simulate this situation. The initial exposure of the elastomers to the conventional fluid for three days at 70° C is based on standard accelerated test conditions simulating extended field exposure. These conditions are found in brake fluid specifications (ref 4) and are based on correlating laboratory and field test observations. In this study it was found that the presoaking in conventional fluids would not affect performance in silicone fluids. In the replacement of conventional fluids with silicone fluids, rubber parts already in the system would not need to be replaced.



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## SECTION 3. APPENDICES

### APPENDIX A - TABLES





(Page A-2 Blank)

TABLE A-1. TESTS AT AMBIENT TEMPERATURE

| Conditions[a] | Time | EPDM (RM69) | | EPDM (70 Duro) | | EPDM (80 Duro) | | Natural Rubber (60 Duro) | | SBR (50 Duro) | | SBR (63 Duro) (SAE) | | SBR (70 Duro) | | Viton (70 Duro) | | Neoprene | | Butyl (60 Duro) | | Buna N (60 Duron) 33% ACN | | Buna N (70 Duron) 21% ACN | | (70 Duron) 41% ACN | | Silicone (60 Duro) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c |
| Silicone Base | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Compatibility | 1 week | -3 | 11.6 | -3 | 7.64 | -1 | 4.26 | -2 | 13.2 | -5 | 13.5 | -8 | 15.9 | -4 | 15.0 | - 5 | 30.7 | -3 | 18.9 | -1 | 2.30 | -3 | 13.5 | -6 | 12.9 | -3 | 6.15 | -10 | 41.1 |
| Fluid (RM70) | 3 weeks | -4 | 12.1 | -2 | 7.54 | -3 | 4.57 | -6 | 13.4 | -7 | 17.6 | -9 | 17.0 | -9 | 15.0 | - 9 | 41.7 | -4 | 21.5 | +1 | 1.32 | -6 | 7.96 | -9 | 15.7 | -4 | 4.85 | -11 | 61.2 |
| | 7 weeks | -4 | 11.8 | -2 | 6.91 | -5 | 5.97 | -7 | 14.0 | -6 | 19.2 | -8 | 17.1 | -9 | 16.1 | - 9 | 43.7 | -4 | 22.7 | +1 | 1.14 | -6 | 9.47 | -9 | 16.2 | -5 | 5.77 | -14 | 68.7 |
| | 6 months | -4 | 11.5 | -2 | 7.49 | -2 | 4.13 | -3 | 13.3 | -5 | 15.3 | -7 | 18.5 | -8 | 15.2 | - 8 | 46.6 | -3 | 21.5 | +1 | 1.88 | -4 | 18.3 | -9 | 21.3 | -3 | 11.5 | -12 | 43.1 |
| | 1 year | -3 | 12.9 | +1 | 7.50 | ±0 | 4.40 | -4 | 14.3 | -5 | 13.8 | -8 | 18.2 | -7 | 15.6 | - 9 | 47.5 | -3 | 21.9 | +1 | 3.14 | -4 | 18.1 | -8 | 16.5 | -3 | 10.7 | -15 | 44.8 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | -3 | 4.82 | -3 | 16.0 | -1 | 6.27 | -2 | 11.4 | -5 | 16.8 | -8 | 17.0 | -4 | 13.8 | - 5 | 10.9 | -3 | 9.07 | -1 | 2.68 | -3 | 16.3 | -6 | 14.7 | -3 | 3.63 | -10 | 45.2 |
| | 3 weeks | -4 | 4.36 | -2 | 15.5 | -3 | 6.01 | -6 | 10.8 | -7 | 18.2 | -9 | 18.4 | -9 | 15.3 | - 9 | 39.0 | -4 | 10.7 | +1 | 6.02 | -6 | 18.7 | -9 | 16.5 | -4 | - 1.36 | -11 | 57.6 |
| | 7 weeks | -4 | 4.53 | -2 | 12.5 | -5 | 7.41 | -7 | 11.3 | -6 | 19.7 | -8 | 18.3 | -9 | 16.2 | - 9 | 43.3 | -4 | 14.4 | +1 | 5.55 | -6 | 18.8 | -9 | 16.9 | -5 | 2.39 | -14 | 62.0 |
| | 6 months | -4 | 4.34 | -2 | 15.9 | -2 | 8.78 | -3 | 12.1 | -5 | 17.3 | -7 | 18.5 | -8 | 14.2 | - 8 | 44.0 | -3 | 13.1 | +1 | 2.21 | -4 | 20.5 | -9 | 23.3 | -3 | - 0.010 | -12 | 46.9 |
| | 1 year | -2 | 5.46 | +1 | 15.5 | -1 | 7.13 | -4 | 11.6 | -4 | 16.2 | -9 | 19.5 | -5 | 13.6 | - 9 | 44.4 | -3 | 13.3 | +4 | 3.38 | -5 | 20.5 | -8 | 17.1 | -2 | 0.815 | -16 | 48.2 |
| Conventional | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Compatibility | 1 week | -5 | 0.721 | -2 | 0.052 | -1 | -0.957 | -5 | 2.24 | -4 | 2.87 | -6 | 2.97 | -4 | 3.32 | - 6 | 125.0 | -6 | 12.4 | -2 | -0.228 | -8 | 44.1 | -8 | 20.7 | -9 | 39.2 | - 3 | - 1.54 |
| Fluid (RM66-06) | 3 weeks | -4 | 0.973 | -1 | 0.016 | -2 | -0.205 | -4 | 1.78 | -3 | 0.527 | -3 | 0.355 | -5 | 1.25 | -27 | 189.0 | -7 | 22.7 | -3 | -2.68 | -9 | 42.1 | -8 | 15.0 | -9 | 34.5 | ± 0 | 0.462 |
| | 7 weeks | ±0 | 0.537 | +2 | 0.194 | +1 | 0.106 | -2 | 1.52 | -1 | 1.66 | ±0 | 2.04 | -1 | 2.39 | -37 | 213.0 | -5 | 6.65 | +1 | 1.00 | -6 | 35.5 | -5 | 9.24 | -7 | 32.3 | + 3 | 2.20 |
| | 6 months | -3 | - 0.18 | +2 | 0.74 | ±0 | -1.46 | ±0 | 0.322 | -3 | 0.289 | -1 | 0.182 | +1 | - 0.335 | -35 | 238.0 | ±0 | 5.30 | +3 | -1.56 | -6 | 26.2 | -3 | 2.32 | -5 | 49.0 | + 3 | 1.48 |
| | 1 year | ±0 | 0.045 | +3 | 1.80 | +1 | 2.65 | -2 | 2.76 | -1 | 1.96 | +3 | - 0.605 | +5 | - 0.469 | -47 | 139.0 | +4 | 11.5 | +2 | 2.02 | -4 | 19.1 | +4 | - 5.27 | -4 | 15.1 | + 5 | 1.56 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | -5 | 1.28 | -2 | 0.423 | -4 | -0.854 | -5 | 1.67 | -4 | 3.11 | -6 | 8.39 | -4 | 3.05 | - 6 | 125.0 | -6 | 6.40 | -2 | -0.161 | -8 | 43.7 | -8 | 21.9 | -9 | 38.5 | - 3 | - 0.709 |
| | 3 weeks | -4 | 0.44 | -1 | 3.81 | -2 | -1.27 | -4 | 1.06 | -3 | 1.14 | -3 | 5.75 | -5 | 0.811 | -27 | 187.0 | -7 | 8.65 | -3 | -2.38 | -9 | 40.9 | -8 | 16.1 | -9 | 34.6 | ± 0 | 3.10 |
| | 7 weeks | ±0 | 1.08 | +2 | 0.66 | +1 | 1.02 | -2 | 0.948 | -1 | 2.17 | ±0 | 7.15 | -1 | 1.98 | -27 | 213.0 | -5 | 6.42 | +1 | -0.589 | -6 | 34.8 | -5 | 10.4 | -7 | 31.5 | + 3 | - 5.13 |
| | 6 months | -3 | 6.95 | +2 | 0.41 | ±0 | -0.59 | ±0 | 0.152 | -3 | - 0.239 | -1 | 5.49 | +1 | - 1.27 | -35 | 243.0 | ±0 | 4.50 | +3 | -1.50 | -6 | 25.7 | -3 | 2.98 | -5 | 22.3 | + 3 | - 2.38 |
| | 1 year | ±0 | 0.53 | +2 | 2.83 | +4 | 3.41 | -1 | 2.29 | -2 | 2.33 | -1 | 1.98 | +3 | - 0.962 | -47 | 194.0 | +4 | 4.37 | +2 | 2.19 | -5 | 18.3 | +3 | - 4.27 | -4 | 13.8 | + 5 | - 2.22 |
| Silicone Base | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fluid Code A | 1 week | -4 | 6.52 | -3 | 6.81 | -3 | 5.81 | -2 | 28.9 | -5 | 11.5 | -7 | 8.59 | -4 | 9.97 | - 2 | 5.39 | -1 | 3.99 | -1 | 2.58 | -2 | 4.29 | -6 | 4.77 | -2 | 2.78 | -11 | 52.2 |
| | 3 weeks | -4 | 7.18 | -3 | 7.72 | -5 | 6.81 | -3 | 14.1 | -7 | 4.02 | -7 | 12.7 | -6 | 10.8 | - 2 | 7.34 | -1 | 4.52 | -2 | 2.01 | -2 | 2.55 | -6 | 4.99 | -2 | 0.831 | -11 | 58.2 |
| | 7 weeks | -5 | 8.02 | -2 | 8.03 | -4 | 7.23 | +2 | 8.04 | -8 | 5.89 | -7 | 14.1 | -7 | 15.3 | - 1 | 8.56 | -2 | 5.62 | +1 | 2.46 | -9 | 3.02 | -7 | 5.52 | -1 | 1.33 | -12 | 61.2 |
| | 6 months | -3 | 7.92 | ±0 | 7.40 | -3 | 7.47 | +4 | 17.3 | -3 | 5.51 | -5 | 14.3 | -5 | 13.1 | - 2 | 11.8 | +1 | 4.40 | +1 | 2.04 | -4 | 4.05 | -3 | 3.71 | +2 | 4.83 | -11 | 60.9 |
| | 1 year | -1 | 3.52 | ±0 | 6.34 | -2 | 4.89 | +4 | 15.6 | -5 | 3.34 | -7 | 9.91 | -5 | 9.11 | - 2 | 11.8 | ±0 | 3.84 | +3 | -0.14 | -5 | 0.032 | -3 | 1.35 | +2 | - 3.38 | -14 | 58.7 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | -4 | 6.61 | -3 | 6.25 | -3 | 4.35 | -2 | 30.5 | -5 | 11.7 | -7 | 12.6 | -4 | 10.6 | - 2 | 5.10 | -1 | 3.57 | -1 | 2.73 | -2 | 4.09 | -6 | 5.78 | -2 | 3.76 | -11 | 49.0 |
| | 3 weeks | -4 | 7.91 | -3 | 7.06 | -5 | 5.79 | -3 | 15.5 | -7 | 13.3 | -7 | 14.1 | -6 | 13.1 | - 2 | 6.72 | -1 | 4.07 | -2 | 4.81 | -2 | 2.32 | -6 | 5.82 | -2 | 1.58 | -11 | 61.9 |
| | 7 weeks | -5 | 8.36 | -2 | 7.17 | -4 | 6.70 | +2 | 13.6 | -8 | 14.4 | -7 | 15.3 | -7 | 15.1 | - 1 | 8.42 | -2 | 5.39 | +1 | 2.12 | -9 | 7.34 | -7 | 6.60 | -1 | 2.26 | -12 | 63.1 |
| | 6 months | -3 | 7.74 | ±0 | 7.21 | -3 | 6.56 | +4 | 13.8 | -3 | 11.7 | -5 | 14.7 | -5 | 15.7 | - 2 | 11.3 | +1 | 6.08 | +1 | 1.74 | -4 | 10.6 | -3 | 3.81 | +2 | 1.66 | -11 | 63.2 |
| | 1 year | -2 | 4.51 | +1 | 5.34 | -1 | 4.04 | +5 | 12.2 | -5 | 12.3 | -5 | 9.37 | -4 | 9.34 | - 2 | 10.9 | ±0 | 2.30 | +3 | 0.633 | -5 | 3.78 | -3 | 2.42 | +2 | - 2.17 | -14 | 59.5 |

See footnotes at end of table.

TABLE A-1 (CONT'D)

| Conditions[a] | Time | EPDM (RM69) | | EPDM (70 Duro) | | EPDM (80 Duro) | | Natural Rubber (60 Duro) | | SBR (50 Duro) | | SBR (63 Duro) (SAE) | | Viton (70 Duro) | | (70 Duro) | | Neoprene | | Butyl (60 Duro) | | Buna N (60 Duro) 33% ACN | | Buna N (70 Duro) 21% ACN | | Buna N (70 Duro) 41% ACN | | Silicone (60 Duro) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sample 1 | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c |
| Silicone Base Fluid Code B | 1 week | -5 | 4.97 | -4 | 3.36 | -4 | 3.79 | -8 | 7.22 | -5 | 10.6 | -6 | 10.7 | -5 | 9.65 | - 2 | 4.30 | -2 | 2.43 | -5 | 5.69 | - 4 | 4.41 | -8 | 4.16 | -4 | 2.40 | -10 | 60.9 |
| | 3 weeks | -4 | 6.15 | -3 | 4.67 | -4 | 4.95 | -4 | 9.75 | +5 | 5.44 | -7 | 12.3 | -7 | 11.1 | - 3 | 7.12 | -2 | 3.61 | -9 | 3.35 | - 3 | 7.72 | -9 | 6.57 | -1 | 3.68 | - 7 | 62.8 |
| | 7 weeks | -4 | 8.27 | -4 | 7.59 | -4 | 6.15 | -3 | 12.8 | -6 | 18.2 | -7 | 16.1 | -7 | 14.5 | - 2 | 13.4 | -3 | 7.25 | +1 | 2.65 | - 3 | 12.5 | -7 | 9.46 | -2 | 5.98 | -11 | 67.0 |
| | 6 months | -2 | 5.56 | ±0 | 4.50 | -1 | 4.73 | -3 | 6.00 | -4 | 13.2 | -5 | 13.3 | -6 | 12.3 | - 2 | 15.6 | +1 | 7.00 | +3 | 0.20 | - 1 | 11.5 | -3 | 7.15 | +2 | 4.81 | -11 | 63.1 |
| | 1 year | -2 | 7.52 | -1 | 6.38 | -1 | 6.87 | -5 | 12.4 | -7 | 14.6 | -6 | 15.5 | -5 | 13.8 | - 4 | 19.0 | ±0 | 7.81 | +1 | 2.68 | - 3 | 12.3 | -5 | 8.49 | ±0 | 6.44 | -14 | 66.2 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | -5 | 3.27 | -4 | 3.54 | -4 | 5.35 | -8 | 9.69 | -5 | 9.01 | -6 | 8.05 | -5 | 8.66 | - 2 | 5.05 | -2 | 3.33 | -5 | 1.16 | - 4 | 4.62 | -8 | 4.86 | -4 | 1.49 | -10 | 55.5 |
| | 3 weeks | -4 | 5.04 | -3 | 1.58 | -4 | 5.59 | -4 | 10.7 | +5 | 7.96 | -7 | 12.2 | -7 | 12.0 | - 3 | 3.94 | -2 | 4.61 | -9 | 1.60 | - 3 | 6.36 | -9 | 6.94 | -1 | 2.79 | - 7 | 62.6 |
| | 7 weeks | -4 | 7.85 | -4 | 8.28 | -4 | 7.35 | -3 | 13.7 | -6 | 16.1 | -7 | 15.9 | -7 | 15.1 | - 2 | 13.9 | -3 | 7.89 | +1 | 3.69 | - 3 | 12.3 | -7 | 10.9 | -2 | 4.75 | -11 | 68.8 |
| | 6 months | -2 | 4.70 | ±0 | 4.98 | -1 | 5.25 | -3 | 10.7 | -4 | 12.2 | -5 | 12.6 | -6 | 14.1 | - 2 | 17.5 | +1 | 8.52 | +3 | 1.00 | - 1 | 11.5 | -3 | 7.34 | +2 | 3.40 | -11 | 63.4 |
| | 1 year | -2 | 6.85 | -1 | 6.75 | -1 | 7.65 | -3 | 12.6 | -5 | 14.2 | -6 | 14.7 | -5 | 14.4 | - 2 | 19.1 | ±0 | 8.41 | +1 | 3.62 | - 3 | 11.1 | -4 | 8.41 | -2 | 6.21 | -14 | 66.1 |
| Silicone Base Fluid Code C | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | -1 | 6.31 | -1 | 19.4 | -2 | 7.88 | -3 | 11.4 | -4 | 16.8 | -8 | 11.4 | -6 | 17.4 | - 9 | 43.5 | -4 | 15.9 | -2 | 2.84 | - 4 | 23.7 | -6 | 15.5 | -1 | 7.10 | -10 | 50.3 |
| | 3 weeks | -4 | 6.18 | -1 | 4.62 | -2 | 8.21 | +1 | 11.8 | -7 | 17.0 | -8 | 10.8 | -7 | 17.9 | - 9 | 39.4 | -7 | 18.0 | -2 | 2.77 | - 8 | 28.4 | -8 | 16.2 | -3 | 9.85 | -11 | 48.4 |
| | 7 weeks | -4 | 6.14 | -1 | 4.59 | -2 | 8.94 | +1 | 12.6 | -8 | 19.5 | -9 | 11.6 | -7 | 18.1 | -10 | 40.3 | -9 | 18.1 | -3 | 2.51 | -10 | 32.2 | -9 | 17.0 | -4 | 9.91 | -13 | 49.6 |
| | 6 months | -1 | 4.59 | ±0 | 16.7 | -1 | 5.52 | -3 | 8.00 | -3 | 11.8 | -4 | 9.03 | -5 | 15.9 | - 7 | 36.5 | -2 | 19.3 | -1 | 2.39 | - 4 | 30.0 | -5 | 13.8 | ±0 | 9.69 | -10 | 47.2 |
| | 1 year | ±0 | 3.48 | +1 | 17.3 | +1 | 6.26 | -3 | 8.70 | -3 | 10.3 | -3 | 6.70 | -4 | 11.1 | - 5 | 26.5 | -5 | 15.4 | +1 | 3.21 | - 4 | 20.1 | -5 | 9.32 | -1 | 4.24 | -14 | 41.2 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | -1 | 6.93 | -1 | 5.28 | -2 | 6.87 | -3 | 7.37 | -4 | 11.4 | -1 | 12.3 | -6 | 15.5 | - 9 | 43.0 | -4 | 14.2 | -2 | 3.03 | - 4 | 23.9 | -6 | 14.4 | -1 | 5.62 | -10 | 36.0 |
| | 3 weeks | -4 | 7.02 | -1 | 4.72 | -2 | 6.89 | +1 | 12.2 | -7 | 18.1 | -8 | 11.7 | -7 | 16.7 | - 9 | 39.3 | -7 | 18.2 | -2 | 2.84 | - 8 | 27.1 | -8 | 15.2 | -3 | 8.66 | -11 | 48.1 |
| | 7 weeks | -4 | 7.08 | -1 | 4.58 | -2 | 7.41 | +1 | 12.7 | -8 | 19.5 | -9 | 11.8 | -7 | 17.9 | -10 | 39.4 | -9 | 19.0 | -3 | 2.65 | -10 | 29.5 | -9 | 16.8 | -4 | 9.42 | -13 | 49.5 |
| | 6 months | -1 | 4.96 | ±0 | 2.95 | -1 | 3.33 | -3 | 8.10 | -3 | 11.7 | -4 | 9.51 | -5 | 15.2 | - 7 | 29.2 | -2 | 18.4 | -1 | 2.77 | - 4 | 28.5 | -5 | 13.1 | ±0 | 8.78 | -10 | 47.0 |
| | 1 year | -1 | 3.86 | +1 | 3.67 | ±0 | 5.08 | -2 | 8.53 | -4 | 10.7 | -4 | 7.23 | -4 | 9.97 | - 5 | 26.8 | -3 | 14.8 | +1 | 3.21 | - 5 | 19.2 | -6 | 9.09 | ±0 | 3.73 | -14 | 41.8 |

[a] Test No. 1 ambient temperature.
[b] Change in hardness (points, Shore D).
[c] Change in volume (percent).

TABLE A-2. TESTS AT 70° C (158° F)

| Conditions[a] | Time | EPDM (RM69) | | EPDM (70 Duro) | | EPDM (80 Duro) | | Natural Rubber (60 Duro) | | SBR (50 Duro) | | SBR (63 Duro) (SAE) | | SBR (70 Duro) | | Viton (70 Duro) | | Neoprene | | Butyl (60 Duro) | | Buna N (60 Duro) 33% ACN | | Buna N (70 Duro) 21% ACN | | Buna N (70 Duro) 41% ACN | | Silicone (60 Duro) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c |
| Silicone Base Compatibility Fluid (RM 70) | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -4 | 6.30 | -4 | 5.14 | -4 | 5.47 | -4 | 9.95 | -8 | 10.9 | -10 | 9.41 | -5 | 9.55 | - 6 | 12.5 | -1 | 2.21 | -2 | 1.66 | -2 | 8.16 | - 2 | 2.37 | - 2 | 1.06 | -11 | 54.3 |
| | 1 week | -2 | 5.86 | -3 | 4.57 | -4 | 5.36 | -5 | 9.77 | -6 | 11.1 | -10 | 10.6 | -7 | 9.84 | - 8 | 16.4 | -3 | 1.19 | -1 | 1.30 | -2 | 9.05 | - 4 | 2.10 | ± 0 | 0.454 | -11 | 54.7 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -4 | 6.55 | -4 | 5.13 | -4 | 5.48 | -4 | 9.05 | -8 | 10.5 | -10 | 10.9 | -5 | 9.48 | - 6 | 14.3 | -1 | 2.03 | -2 | 0.988 | -2 | 8 23 | - 2 | 1.72 | - 2 | 0.689 | -11 | 54.7 |
| | 1 week | -2 | 5.88 | -3 | 4.80 | -4 | 5.45 | -5 | 9.27 | -6 | 10.4 | -10 | 10.9 | -7 | 9.88 | - 8 | 18.7 | -3 | 1.77 | -1 | 0.72 | -2 | 9.07 | - 4 | 2.21 | ± 0 | 0.471 | -11 | 56.3 |
| | | | | | | | | | | | | White Sediment | | | | | | | | | | | | | | | | Swelled | |
| Conventional Compatibility Fluid (RM 66 06) | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -2 | 0.784 | -1 | 0.58 | -1 | 1.73 | -1 | 1.35 | -6 | 3.98 | - 5 | 4.04 | -4 | 4.24 | -12 | 65.5 | -7 | 10.5 | ±0 | -0.056 | -8 | 60.6 | -15 | 37.7 | - 9 | 48.9 | + 2 | - 0.422 |
| | 1 week | -2 | 0.589 | ±0 | 0.591 | -1 | 4.99 | -4 | 1.62 | -3 | 6.24 | - 6 | 4.50 | -3 | 1.83 | -17 | 86.4 | -7 | 9.59 | +2 | 4.29 | -7 | 65.8 | -15 | 36.1 | -11 | 47.5 | + 3 | - 0.139 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -2 | 1.40 | -1 | 0.778 | -1 | 1.95 | -1 | 1.24 | -6 | 3.78 | - 5 | 4.42 | -4 | 4.31 | -12 | 69.2 | -7 | 10.1 | ±0 | 0.631 | -8 | 61.0 | -15 | 38.9 | - 9 | 48.9 | + 2 | - 0.952 |
| | 1 week | -2 | 0.991 | ±0 | 0.433 | -1 | 4.89 | -4 | 1.77 | -3 | 5.51 | - 6 | 7.63 | -3 | 2.14 | -17 | 94.8 | -7 | 9.07 | +2 | 4.26 | -7 | 59.5 | -15 | 37.3 | -11 | 47.5 | + 3 | - 0.581 |
| | | | | | | | | | | | | | | | | Swelled | | | | | | Swelled | | Swelled | | Swelled | | Sediment | |
| Silicone Base Fluid Code A | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -5 | 3.86 | -4 | 7.68 | -4 | 4.59 | -2 | 9.32 | -7 | 8.48 | - 7 | 9.78 | -7 | 6.69 | - 4 | 4.25 | -1 | - 0.343 | -2 | 0.823 | -3 | 0.403 | ± 0 | - 3.41 | ± 0 | - 2.63 | -10 | 53.7 |
| | 1 week | -5 | 6.00 | -5 | 8.42 | -4 | 4.49 | -4 | 8.54 | -6 | 9.63 | - 6 | 6.56 | -5 | 6.56 | - 5 | 8.53 | +3 | - 1.58 | -2 | 0.805 | +1 | - 0.282 | + 3 | - 4.96 | + 3 | - 4.41 | -11 | 54.3 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -5 | 5.22 | -4 | 5.37 | -4 | 4.87 | -2 | 7.49 | -7 | 8.53 | - 7 | 8.83 | -7 | 8.50 | - 4 | 4.17 | -1 | - 0.392 | -2 | 0.643 | -3 | 1.34 | ± 0 | - 3.42 | ± 0 | - 3.34 | -10 | 55.6 |
| | 1 week | -5 | 5.88 | -5 | 5.05 | -4 | 4.64 | -4 | 7.12 | -6 | 8.49 | - 8 | 8.36 | -6 | 8.38 | - 5 | 6.26 | +3 | - 1.58 | -2 | 0.229 | +1 | 0.015 | + 3 | - 3.53 | + 3 | - 5.25 | -11 | 54.3 |
| | | | | | | | Sediment | | | | Sediment | | | | | | Sediment | | | | | | | | | | Sediment | | Swelled |
| Silicone Base Fluid Code B | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -3 | 5.53 | -3 | 5.15 | -4 | 4.93 | -4 | 7.12 | -5 | 7.33 | - 8 | 7.55 | -5 | 6.58 | - 3 | 3.99 | -2 | 0.488 | ±0 | 0.016 | -2 | 4.58 | - 1 | 1.39 | - 2 | 1.01 | -11 | 57.2 |
| | 1 week | -2 | 5.68 | -2 | 5.60 | -3 | 6 14 | -3 | 7.69 | -4 | 8.06 | - 6 | 8.58 | -5 | 8.33 | - 3 | 6.34 | ±0 | 0.093 | +2 | 1.28 | +1 | 4.28 | ± 0 | 1.63 | - 5 | 1.30 | -12 | 60.3 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -3 | 5.69 | -3 | 4.63 | -4 | 5.01 | -4 | 7.12 | -5 | 7 84 | - 8 | 8.12 | -5 | 6.99 | - 3 | 5.47 | -2 | 0.875 | ±0 | 0.355 | -2 | 3.71 | - 1 | 2.22 | - 2 | 1.62 | -11 | 60.3 |
| | 1 week | -2 | 5.72 | -2 | 5.54 | -3 | 5.54 | -3 | 7.50 | -4 | 7.78 | - 6 | 8.37 | -5 | 7.84 | - 3 | 7.52 | ±0 | 0.481 | +2 | 0.994 | +1 | 4.12 | ± 0 | 1.92 | - 5 | 1.85 | -12 | 61.9 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | Swelled | |
| Silicone Base Fluid Code C | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -5 | 7.44 | -4 | 5.52 | -4 | 6.11 | -5 | 11.6 | -7 | 15.6 | -10 | 11.8 | -7 | 10.0 | - 8 | 15.8 | -2 | 4.21 | -1 | 1.14 | -1 | 9 61 | - 3 | 4.37 | ± 0 | 0.824 | -10 | 54.6 |
| | 1 week | -5 | 8.03 | -4 | 6.08 | -5 | 7.63 | -9 | 12.8 | -7 | 15 5 | - 9 | 10.9 | -6 | 9.88 | - 8 | 19.0 | -2 | 4.24 | -1 | 5.11 | -3 | 10 3 | - 2 | 11.7 | + 1 | 0.01 | -19 | 66.7 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -5 | 8.87 | -4 | 5.16 | -4 | 6 30 | -5 | 11.3 | -7 | 10.7 | -10 | 11.6 | -7 | 9.49 | - 8 | 6.24 | -2 | 3.17 | -1 | 1.51 | -1 | 9 50 | - 3 | 0.04 | ± 0 | 0.72 | -10 | 53.8 |
| | 1 week | -5 | 8.01 | -4 | 5.93 | -5 | 6.84 | -9 | 12.3 | -7 | 11.4 | - 9 | 10.5 | -6 | 9.64 | - 8 | 18.8 | -2 | 3.88 | -1 | 5.34 | -3 | 10.4 | - 2 | 2.02 | + 1 | 0.195 | -19 | 67.6 |

[a]Test No. 2 70° C.
[b]Change in hardness (points, Shore D).
[c]Change in volume (percent)

TABLE A-3. TESTS AT 120° C (248° F)

| Conditions[a] | Time | EPDM (RM59) b | EPDM (RM59) c | EPDM (70 Duro) b | EPDM (70 Duro) c | EPDM (80 Duro) b | EPDM (80 Duro) c | Natural Rubber (60 Duro) b | Natural Rubber (60 Duro) c | SBR (50 Duro) b | SBR (50 Duro) c | SBR (63 Duro) (SAE) b | SBR (63 Duro) (SAE) c | SBR (70 Duro) b | SBR (70 Duro) c | Viton (70 Duro) b | Viton (70 Duro) c | Neoprene b | Neoprene c | Butyl (60 Duro) b | Butyl (60 Duro) c | Buna N (60 Duro) 33% ACN b | Buna N (60 Duro) 33% ACN c | Buna N (70 Duro) 21% ACN b | Buna N (70 Duro) 21% ACN c | Buna N (70 Duro) 41% ACN b | Buna N (70 Duro) 41% ACN c | Silicone (60 Duro) b | Silicone (60 Duro) c |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Silicone Base Compatibility Fluid (RM 70) | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -6 | 5.13 | -5 | 7.15 | -6 | 6.19 | -27 | 9.30 | -3 | 8.62 | - 3 | 8.35 | - 5 | 8.62 | - 7 | 13.6 | - 2 | 2.69 | - 9 | 3.96 | +10 | 5.87 | +10 | - 7.05 | ± 0 | 0.028 | -24 | 71.2 |
| | 1 week | -6 | 9.09 | -4 | 10.9 | -7 | 18.0 | -19 | 17.8 | +1 | 18.4 | + 3 | 13.9 | + 2 | 19.8 | - 6 | 19.5 | + 5 | 17.2 | -14 | 9.51 | +14 | 18.8 | +14 | 4.48 | + 6 | 12.6 | -29 | 82.5 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -8 | 9.32 | -5 | 6.91 | -6 | 6.16 | -27 | 11.5 | -3 | 8.23 | - 3 | 8.71 | - 5 | 9.71 | - 7 | 12.3 | - 2 | 4.87 | - 9 | 3.50 | +10 | 5.65 | +10 | - 0.492 | ± 0 | 0.188 | -24 | 69.7 |
| | 1 week | -8 | 12.9 | -4 | 11.1 | -7 | 17.0 | -19 | 16.4 | +1 | 24.0 | + 3 | 15.6 | + 2 | 20.2 | - 6 | 18.5 | + 5 | 14.9 | -14 | 9.83 | +14 | 18.9 | +14 | 4.59 | + 6 | 12.3 | -20 | 79.6 |
| | | Sediment | | | | | | Sediment | | Sediment | | Brittle and Sediment | | Sediment | | | | | | | | Sediment | | Brittle | | Sediment | | Swelled and Breaking Down | |
| Conventional Compatibility Fluid (RM 66-06) | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -5 | 1.15 | ±0 | 1.79 | -2 | 1.64 | -10 | 3.15 | -6 | 7.13 | - 8 | 7.30 | - 4 | 7.01 | -19 | 68.1 | -12 | 17.0 | ± 0 | 4.71 | - 5 | 82.7 | -16 | 49.7 | -17 | 65.0 | - 1 | - 0.500 |
| | 1 week | -5 | 1.95 | -1 | 2.05 | ±0 | 1.78 | - 9 | 4.07 | -4 | 6.82 | - 7 | 7.38 | - 8 | 7.63 | -27 | 85.3 | -13 | 18.1 | ± 0 | 7.33 | -16 | 105.0 | -23 | 97.6 | -18 | 67.3 | - 2 | - 0.159 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -5 | 0.761 | ±0 | 2.09 | -2 | 1.78 | -10 | 2.66 | -6 | 7.55 | - 8 | 7.46 | - 4 | 8.05 | -19 | 63.4 | -12 | 16.7 | ± 0 | 4.71 | - 5 | 79.2 | -16 | 38.9 | -17 | 66.0 | - 1 | - 0.523 |
| | 1 week | -5 | 1.61 | -1 | 1.32 | ±0 | 1.97 | - 9 | 3.62 | -4 | 7.59 | - 7 | 6.73 | - 8 | 8.04 | -27 | 85.5 | -13 | 18.3 | ± 0 | 6.90 | -16 | 99.2 | -23 | 76.6 | -18 | 65.8 | - 2 | - 0.761 |
| | | | | | | | | | | | | | | | | Swelled and Breaking Down | | | | | | Swelled and Sediment | | Swelled and Very Soft | | Swelled | | | |
| Silicone Base Fluid Code A | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -4 | 5.83 | -3 | 4.81 | -5 | 5.47 | - 7 | 6.20 | -5 | 7.41 | - 9 | 7.32 | - 5 | 6.08 | - 3 | 4.38 | ± 0 | - 1.23 | ± 0 | - 0.269 | + 2 | - 0.229 | + 1 | - 2.73 | + 1 | - 4.78 | -11 | 55.1 |
| | 1 week | -7 | 6.45 | -5 | 5.11 | -5 | 5.84 | -10 | 5.97 | -6 | 6.41 | - 4 | 6.02 | - 5 | 4.90 | - 3 | 5.95 | + 4 | - 3.02 | - 4 | 1.24 | ± 0 | 1.24 | + 7 | - 6.41 | ± 0 | - 7.00 | -10 | 57.7 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -4 | 6.19 | -3 | 4.99 | -5 | 5.57 | - 7 | 7.23 | -5 | 8.74 | - 9 | 8.74 | - 5 | 7.03 | - 3 | 5.07 | ± 0 | - 1.87 | ± 0 | - 4.55 | + 2 | 0.517 | + 1 | - 4.18 | + 1 | - 3.43 | -11 | 58.9 |
| | 1 week | -7 | 7.50 | -5 | 4.97 | -5 | 5.50 | -10 | 6.65 | -6 | 7.57 | - 4 | 7.54 | - 5 | 6.00 | - 3 | 6.14 | + 4 | - 3.33 | - 4 | 1.74 | ± 0 | - 1.05 | + 7 | - 6.97 | ± 0 | - 6.89 | -10 | 60.0 |
| | | | | | | | | Sediment | | | | | | | | Swelled | | | | | | | | | | | | Swelled | |
| Silicone Base Fluid Code B | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -3 | 3.96 | -3 | 7.12 | -3 | 5.88 | - 9 | 7.59 | -5 | 8.65 | - 9 | 7.87 | - 6 | 7 16 | - 3 | 6.71 | + 1 | - 1.69 | ± 0 | - 0.064 | + 1 | 3.84 | ± 0 | 16.9 | + 1 | - 2.96 | -11 | 63.2 |
| | 1 week | -5 | 5.11 | -7 | 6.47 | -6 | 5.40 | -11 | 6.41 | -6 | 5.29 | - 9 | 6.63 | - 6 | 5.21 | - 3 | 6.27 | + 4 | - 5 39 | - 3 | 0.883 | ± 0 | 3.39 | + 5 | - 6.29 | + 1 | - 5.90 | -15 | 74.5 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -3 | 7.43 | -3 | 7.46 | -3 | 6.48 | - 9 | 8.42 | -5 | 9.34 | - 9 | 8.07 | - 6 | 7.30 | - 3 | 5.18 | + 1 | - 1 56 | ± 0 | 0.066 | + 1 | 3.44 | ± 0 | 17.3 | + 1 | - 3.16 | -11 | 62.7 |
| | 1 week | -5 | 7 70 | -7 | 6.35 | -6 | 5.64 | -11 | 7.66 | -6 | 5.67 | - 9 | 7.84 | - 6 | 4.51 | - 3 | 5.70 | + 4 | - 6.80 | - 3 | 0.048 | ± 0 | 2.59 | + 5 | - 6.10 | + 1 | - 5.58 | -15 | 71.3 |
| | | | | | | | | | | | | | | | | | | | | | | Sediment | | Sediment | | | | Swelled | |
| Silicone Base Fluid Code C | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 72 hours | -6 | 7.49 | -5 | 15.7 | -6 | 7.23 | -20 | 12.6 | -7 | 12.3 | - 6 | 12 3 | - 8 | 9.55 | - 7 | 13 2 | - 3 | 2.98 | - 2 | 4.57 | - 4 | 9.17 | - 4 | 2.42 | -11 | - 0.134 | -22 | 73.2 |
| | 1 week | -8 | 10.1 | -6 | 17.1 | -8 | 8.66 | -33 | 14.5 | -8 | 11.8 | -15 | 8.53 | -12 | 10.2 | - 9 | 16.6 | - 5 | 7 24 | - 4 | 11.9 | - 3 | 11.3 | - 4 | 0.994 | - 3 | 2 30 | | |

See footnotes at end of table.

TABLE A-4. 50/50 MIXTURES OF SILICONE AND CONVENTIONAL FLUID AMBIENT TEMPERATURE

| Conditions[a] | Time | EPDM (RM69) | | EPDM (70 Duro) | | EPDM (80 Duro) | | Natural Rubber (60 Duro) | | SBR (50 Duro) | | SBR (63 Duro) (SAE) | | SBR (70 Duro) | | Viton (70 Duro) | | Neoprene | | Butyl (60 Duro) | | Buna N (60 Duro) 33% ACN | | Buna N (70 Duro) 21% ACN | | Buna N (70 Duro) 41% ACN | | Silicone (60 Duro) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c |
| Silicone Base Compatibility Fluid (RM 70) | Sample 1 (TOP) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | -5 | 1.44 | -4 | 1.14 | -3 | -2.58 | +4 | 4.05 | -5 | 6.06 | -3 | 5.89 | -4 | 5.58 | -19 | 72.2 | -5 | 6.04 | -3 | -0.203 | -5 | 30.4 | -8 | 19.1 | -6 | 25.6 | -15 | 52.7 |
| | 2 months | -6 | 2.82 | -5 | 3.09 | -5 | 2.79 | -6 | 5.84 | -6 | 4.12 | -5 | 7.12 | -4 | 4.03 | -29 | 143.0 | -7 | 6.29 | -5 | 0.420 | -7 | 32.5 | -5 | 4.15 | -10 | 34.5 | -18 | 57.7 |
| | 6 months | -3 | 2.33 | -4 | 1.32 | -4 | 2.94 | -4 | 5.02 | ±0 | 2.95 | -3 | 4.70 | -2 | 2.99 | -25 | 166.0 | -4 | 1.94 | +1 | 0.354 | -4 | 21.3 | -4 | 5.10 | -6 | 24.0 | -15 | 60.2 |
| | 1 year | -4 | 2.40 | -2 | 2.06 | -3 | 2.79 | -3 | 4.95 | -3 | 3.93 | -2 | 4.93 | -2 | 3.32 | -34 | 170.0 | -3 | 1.91 | +1 | 0.195 | -2 | 20.8 | -4 | 5.16 | -6 | 22.1 | -18 | 61.3 |
| | Sample 2 (BOT) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | -6 | 1.60 | -3 | 1.12 | -3 | -1.71 | +3 | 4.45 | -4 | 5.24 | -4 | 5.32 | -4 | 6.35 | -24 | 187.0 | -6 | 9.56 | ±0 | 0.818 | -7 | 47.4 | -9 | 18.4 | -8 | 37.3 | -10 | 30.2 |
| | 2 months | -6 | 2.98 | -5 | 4.26 | -5 | 3.20 | -5 | 5.80 | -8 | 5.71 | -6 | 7.08 | -4 | 6.57 | -39 | 260.0 | -7 | 8.23 | -2 | 0.900 | -8 | 40.8 | -9 | 19.1 | -10 | 35.1 | -14 | 49.9 |
| | 6 months | -3 | 2.35 | -3 | 1.93 | -3 | 3.07 | -3 | 4.55 | -3 | 3.89 | -3 | 5.90 | -2 | 4.40 | -39 | 261.0 | -5 | 3.88 | +1 | 0.222 | -5 | 26.7 | -5 | 9.92 | -6 | 27.0 | -14 | 57.3 |
| | 1 year | -5 | 2.41 | -3 | 2.15 | -3 | 2.65 | -2 | 4.79 | -3 | 3.77 | -2 | 5.59 | -1 | 3.94 | -52 | 288.0 | -2 | 2.23 | ±0 | 0.072 | -4 | 22.9 | -4 | 6.10 | -6 | 22.3 | -16 | 60.2 |
| Silicone Base Fluid Code A | Sample (TOP) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | ±0 | 5.02 | +1 | 3.07 | ±0 | 1.64 | -1 | 10.3 | -2 | 7.58 | ±0 | 7.66 | -2 | 9.66 | -22 | 83.8 | -3 | 5.76 | -3 | 0.762 | -5 | 32.0 | -3 | 12.1 | -2 | 23.5 | -10 | 55.8 |
| | 2 months | -4 | -1.66 | -2 | 0.23 | ±0 | -0.58 | -4 | 7.03 | -6 | 2.68 | -3 | 4.01 | -3 | 3.59 | -26 | 119.0 | -4 | -0.59 | ±0 | -3.14 | -11 | 28.6 | -1 | -1.96 | -7 | 18.1 | -14 | 75.7 |
| | 6 months | ±0 | 3.79 | ±0 | 3.38 | +2 | 1.35 | -1 | 9.52 | -1 | 4.81 | ±0 | 5.51 | ±0 | 5.40 | -26 | 128.0 | ±0 | 1.28 | +5 | -0.513 | -4 | 23.3 | +2 | -0.226 | -1 | 13.0 | -13 | 62.5 |
| | 1 year | -2 | 4.38 | -2 | 4.16 | ±0 | 2.50 | -1 | 11.1 | -1 | 6.38 | -1 | 7.32 | -1 | 6.07 | -30 | 170.0 | -1 | 4.37 | +3 | 0.925 | -6 | 24.3 | ±0 | 4.59 | -2 | 15.7 | -14 | 63.2 |
| | Sample 2 (BOT) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | ±0 | 2.11 | +1 | 0.373 | +2 | 0.915 | -1 | 4.33 | -2 | 5.16 | ±0 | 4.32 | -2 | 4.84 | -22 | 169.0 | -2 | 8.16 | -3 | 0.916 | -8 | 47.4 | -5 | 18.5 | -3 | 37.6 | -10 | 30.9 |
| | 2 months | -4 | -1.27 | -3 | -2.69 | ±0 | 1.58 | -4 | 1.25 | -5 | 3.54 | -3 | 2.11 | -5 | 4.23 | -34 | 247.0 | -6 | 5.29 | +1 | -1.41 | -11 | 35.8 | -8 | 14.8 | -9 | 27.6 | -15 | 49.8 |
| | 6 months | ±0 | 2.13 | +1 | 0.678 | +1 | 3.13 | ±0 | 3.85 | -1 | 5.46 | -1 | 4.75 | -2 | 6.17 | -42 | 251.0 | -1 | 4.91 | +3 | 0.185 | -6 | 29.7 | -3 | 9.96 | -3 | 20.7 | -13 | 59.4 |
| | 1 year | -2 | 2.35 | -1 | 1.04 | +0 | 3.88 | -1 | 4.98 | -1 | 5.95 | -1 | 5.01 | -2 | 6.37 | -29 | 279.0 | ±0 | 3.09 | +2 | 1.61 | -7 | 25.5 | -1 | 6.61 | -2 | 17.9 | -14 | 60.4 |
| Silicone Base Fluid Code B | Sample (TOP) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | ±0 | 3.80 | ±0 | 1.32 | +2 | 12.5 | -2 | 4.02 | -1 | 5.64 | -1 | -1.17 | -2 | 6.03 | - 9 | 41.0 | -3 | 3.75 | +2 | 0.436 | -4 | 26.5 | -3 | 13.8 | -3 | 25.0 | -9 | 2.63 |
| | 2 months | -5 | -2.59 | -5 | -7.00 | -2 | 9.62 | -4 | -1.50 | -6 | 0.70 | -3 | -8.62 | -7 | -4.97 | -23 | 95.8 | -3 | -0.33 | ±0 | -3.94 | -7 | 21.6 | -5 | 2.64 | -5 | 12.0 | -18 | 2.32 |
| | 6 months | ±0 | 1.97 | -1 | 2.52 | +2 | 13.5 | -1 | 4.53 | -1 | 3.76 | -1 | -1.69 | ±0 | 10.8 | -20 | 120.0 | +2 | -0.32 | +3 | 0.246 | -2 | 13.9 | +2 | 1.09 | -2 | 10.7 | -12 | 5.78 |
| | 1 year | -3 | 3.11 | -1 | 2.85 | ±0 | 14.1 | -1 | 4.93 | -4 | 3.90 | -1 | -1.09 | ±0 | 4.50 | -25 | 153.0 | ±0 | 1.47 | +3 | 0.886 | - | - | ±0 | 2.69 | -3 | 11.9 | -16 | 6.83 |
| | Sample 2 (BOT) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | ±0 | 0.772 | -2 | 5.26 | +2 | 1.18 | -1 | 4.23 | -1 | -3.21 | -1 | 6.12 | ±0 | 5.78 | -18 | 166.0 | -3 | 7.89 | +2 | -1.31 | -7 | 44.7 | -5 | 22.8 | -5 | 41.7 | -7 | -14.7 |
| | 2 months | -5 | -3.32 | -5 | -4.14 | -2 | -1.14 | -3 | -0.73 | -5 | -7.43 | -3 | -4.84 | -7 | -1.80 | -25 | 233.0 | -5 | 6.19 | ±0 | -8.44 | -11 | 32.8 | -7 | 10.8 | -5 | 31.6 | -18 | -3.15 |
| | 6 months | ±0 | 1.62 | -1 | 2.62 | +2 | 1.54 | -1 | 4.11 | +1 | -5.12 | ±0 | 5.58 | -1 | 4.18 | -53 | 240.0 | -3 | 3.00 | +3 | -1.04 | -4 | 25.4 | ±0 | 6.05 | -2 | 23.1 | -12 | 2.63 |
| | 1 year | -2 | 2.13 | -1 | 2.11 | +1 | 2.21 | -2 | 4.[illegible] | -2 | -5.06 | ±0 | 5.84 | -1 | 4.32 | -48 | 264.0 | +1 | 1.43 | +2 | -0.526 | - | - | ±0 | 4.45 | -4 | 20.6 | -15 | 4.69 |
| Silicone Base Fluid Code C | Sample 1 (TOP) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | -1 | -1.54 | -4 | -7.45 | -3 | -1.41 | -3 | 2.70 | -6 | -0.432 | -5 | 0.615 | -4 | 2.87 | -16 | 45.4 | -4 | 0.022 | -2 | -18.6 | -12 | 23.3 | -7 | 17.2 | -7 | 21.7 | -13 | 51.6 |
| | 2 months | -4 | 2.99 | -5 | 2.41 | -5 | -0.95 | -6 | 4.74 | -5 | 3.10 | -5 | 4.62 | -4 | 3.80 | -31 | 112.0 | -4 | -0.08 | -4 | -0.470 | -13 | 32.8 | -8 | 9.82 | -10 | 31.9 | -17 | 54.9 |
| | 6 months | ±0 | 1.08 | -2 | 1.64 | ±0 | -2.18 | -2 | 4.86 | ±0 | 1.18 | -3 | 2.54 | ±0 | 0.646 | -26 | 113.0 | -1 | -2.99 | +1 | -1.27 | -6 | 23.9 | +1 | -0.184 | -3 | 22.9 | -13 | 55.0 |
| | 1 year | -2 | 2.40 | -2 | 1.7[illegible] | -2 | -1.71 | -3 | 4.78 | -3 | 1.75 | -2 | 4.33 | -1 | 2.21 | -28 | 128.0 | -2 | -20.33 | +2 | -0.631 | -12 | 28.2 | -2 | 3.93 | -6 | 24.1 | -16 | 56.3 |

See footnotes at end of table.

TABLE A-4 (CONT'D)

| Conditions[a] | Time | EPDM (R469) | | EPDM (70 Duro) | | EPDM (80 Duro) | | Natural Rubber (60 Duro) | | SBR (50 Duro) | | SBR (63 Duro) (SAE) | | SBR (70 Duro) | | Viton (70 Duro) | | Neoprene | | Butyl (60 Duro) | | Buna N (60 Duro) 33% ACN | | Buna N (70 Duro) 21% ACN | | Buna N (70 Duro) 41% ACN | | Silicone (60 Duro) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c |
| | Sample 2 (BOT) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | -2 | -0.872 | -4 | -9.29 | -3 | -3.91 | -2 | 0.092 | -5 | -1.46 | -4 | 1.04 | -4 | 3.46 | -28 | 178.0 | -7 | 5.68 | -2 | -6.40 | -13 | 41.2 | -7 | 22.4 | -9 | 32.3 | -9 | 30.6 |
| | 2 months | -5 | 3.16 | -6 | 3.02 | -5 | -0.33 | -5 | 4.33 | -7 | 3.83 | -5 | 5.50 | -6 | 13.8 | -45 | 265.0 | -9 | 7.05 | -3 | -0.580 | -15 | 38.9 | -11 | 20.9 | -11 | 19.1 | -14 | 49.6 |
| | 6 months | ±0 | 1.66 | -1 | 1.97 | -1 | -1.33 | -1 | 3.42 | -3 | 2.37 | -2 | 3.57 | -2 | 6.91 | -48 | 286.0 | -3 | 2.00 | ±0 | -1.44 | -7 | 30.3 | -6 | 10.8 | -5 | 28.0 | -13 | 53.7 |
| | 1 year | -1 | 2.17 | -2 | 1.53 | -2 | -0.88 | -2 | 2.93 | -3 | 1.44 | -1 | 4.00 | -2 | 3.36 | -60 | 321.0 | -3 | 0.89 | ±0 | -0.713 | -8 | 25.8 | -3 | 7.01 | -6 | 24.7 | -16 | 56.7 |

[a] Test No. 4 ambient temperature, 50% silicone 50% convent, compatible fluid.
[b] Change in hardness (point, Shore D).
[c] Change in volume (percent).

TABLE A-5. TESTS AT -18° C (0° F)

| Conditions[a] | Time | EPDM (RM69) | | EPDM (70 Duro) | | EPDM (80 Duro) | | Natural Rubber (60 Duro) | | SBR (50 Duro) | | SBR (63 Duro) (SAE) | | SAE (70 Duro) | | Viton (70 Duro) | | Neoprene | | Butyl (60 Duro) | | Buna N (60 Duro) 33% ACN | | Buna N (70 Duro) 21% ACN | | Buna N (70 Duro) 42% ACN | | Silicone (60 Duro) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c |
| Silicone Base Compatibility Fluid (RM 70) | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | -1 | 1.04 | +1 | 0.662 | +1 | 0.304 | -2 | 4.32 | - 3 | 5.88 | -2 | 5.69 | -1 | 5.46 | - 1 | 23.6 | ±0 | 2.38 | +2 | -0.17 | - 2 | 4.67 | - 2 | 11.2 | + 1 | 1.48 | -14 | 53.6 |
| | 2 months | -3 | 3.26 | -2 | 6.70 | ±0 | 1.85 | -5 | 6.62 | - 9 | 16.6 | -5 | 1.19 | -8 | 14.2 | -10 | 49.0 | -4 | 2.86 | -1 | -0.213 | - 4 | 10.3 | -10 | 33.9 | - 3 | 2.66 | -14 | 57.8 |
| | 6 months | -1 | 3.15 | +1 | 0.429 | +2 | 1.98 | -4 | 8.18 | - 9 | 20.3 | -4 | 15.8 | -7 | 18.2 | -11 | 55.2 | -2 | 3.62 | ±0 | -1.09 | - 3 | 13.5 | - 9 | 38.1 | ± 0 | 3.36 | -13 | 59.0 |
| | 1 year | -1 | 4.47 | -1 | 1.70 | +0 | 3.16 | -6 | 10.40 | -10 | 22.7 | -8 | 19.1 | -9 | 21.5 | -15 | 61.8 | -5 | 5.92 | -1 | 0.064 | - 5 | 18.0 | -11 | 38.3 | - 3 | 5.97 | -14 | 60.0 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | -1 | 1.07 | +1 | 0.698 | +1 | 1.40 | -2 | 1.65 | - 3 | 5.54 | -2 | - 2.35 | -1 | 5.61 | - 1 | 18.9 | ±0 | 1.73 | +2 | -0.403 | - 2 | 3.95 | - 2 | 9.57 | + 1 | 1.31 | -14 | 53.0 |
| | 2 months | -3 | 2.71 | -2 | 0.837 | ±0 | 1.67 | -5 | 2.24 | -10 | 16.3 | -8 | 4.30 | -6 | 10.2 | -11 | 49.7 | -2 | 2.11 | ±0 | -1.68 | - 3 | 10.2 | -10 | 30.1 | - 2 | 2.05 | -14 | 57.6 |
| | 6 months | -1 | 2.62 | ±0 | 0.668 | +2 | 1.57 | -4 | 10.8 | - 9 | 20.0 | -6 | 8.43 | -7 | 18.1 | -11 | 56.7 | -1 | 2.95 | ±0 | -1.40 | - 3 | 13.1 | - 9 | 35.3 | ± 0 | 2.73 | -13 | 58.2 |
| | 1 year | -2 | 4.36 | ±0 | 1.95 | ±0 | 2.82 | -6 | 6.56 | -10 | 22.6 | -8 | 11.30 | -9 | 21.3 | -15 | 63.4 | -3 | 5.01 | ±0 | -0.067 | - 5 | 17.3 | -11 | 36.6 | - 2 | 5.51 | -14 | 59.: |
| Conventional Compatibility Fluid (RM 66-06) | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | +1 | -0.884 | +2 | 1.12 | +2 | 0.988 | -2 | 1.67 | + 2 | 0.88 | +1 | 0.939 | +2 | 2.55 | - 9 | 53.1 | ±0 | 2.06 | ±0 | -0.271 | - 1 | 10.4 | + 1 | 10.4 | - 3 | 12.0 | - 1 | 1.26 |
| | 2 months | -1 | 0.548 | ±0 | 1.33 | +1 | 0.854 | -2 | 1.32 | - 4 | 2.34 | -1 | 1.19 | -1 | 3.57 | -29 | 237 | -2 | 2.06 | -2 | -0.191 | - 7 | 25.6 | - 6 | 17.0 | - 8 | 25.2 | - 1 | 1.91 |
| | 6 months | +1 | -1.44 | +1 | 0.625 | +3 | 0.016 | -1 | 1.38 | - 1 | 1.74 | ±0 | 1.36 | -1 | 3.25 | -29 | 306 | +5 | 2.07 | +2 | -0.837 | - 8 | 33.6 | - 6 | 17.0 | - 8 | 38.6 | + 2 | 1.39 |
| | 1 year | -1 | -0.42 | ±0 | 2.03 | ±0 | 1.02 | -3 | 2.48 | - 4 | 2.71 | -2 | 2.35 | -4 | 4.78 | -48 | 343 | -3 | 2.64 | ±0 | -0.016 | -11 | 40.4 | - 6 | 14.7 | -11 | 46.0 | ± 0 | 2.07 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | +1 | 1.02 | +2 | 1.66 | +2 | -2.54 | -2 | - 0.194 | + 2 | 2.34 | +1 | 0.782 | +2 | 1.79 | - 9 | 59.0 | ±0 | 1.58 | ±0 | -0.364 | - 1 | 10.6 | + 1 | 9.09 | - 3 | 11.0 | - 1 | 0.838 |
| | 2 months | ±0 | 0.301 | -1 | 1.04 | +2 | 1.10 | -2 | - 0.343 | - 4 | 3.17 | -1 | 1.27 | -1 | 1.94 | -29 | 246 | -2 | 1.28 | -1 | -0.303 | - 8 | 26.8 | - 6 | 15.2 | - 8 | 24.5 | - 1 | 0.708 |
| | 6 months | ±0 | -0.262 | +1 | -0.121 | +3 | 0.201 | -1 | - 0.305 | - 3 | 3.07 | ±0 | 1.46 | +1 | 2.35 | -31 | 311 | +4 | 0.942 | ±0 | -0.992 | - 8 | 33.7 | - 5 | 15.2 | - 8 | 36.7 | + 2 | 0.228 |
| | 1 year | -1 | 0.964 | ±0 | 1.43 | +2 | 0.884 | -3 | 0.819 | - 4 | 4.14 | -1 | 2.44 | -2 | 3.57 | -50 | 339 | -3 | 1.59 | ±0 | -0.151 | -10 | 39.7 | - 5 | 13.2 | -11 | 44.2 | ± 0 | 0.673 |
| Silicone Base Fluid Code A | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | -1 | 2.42 | ±0 | 1.63 | ±0 | 1.92 | -3 | 1.22 | - 2 | 0.688 | -2 | 4.19 | ±0 | 6.25 | ± 0 | 7.36 | ±0 | 1.54 | +2 | 0.663 | + 2 | 5.28 | + 2 | 2.35 | | 2.23 | -12 | 55.6 |
| | 2 months | -2 | 3.23 | ±0 | 2.33 | ±0 | 2.52 | -5 | 1.91 | - 7 | 12.4 | -4 | 8.06 | -5 | 12.3 | - 3 | 10.8 | -2 | 1.22 | -2 | -1.35 | - 2 | 5.04 | - 3 | 5.93 | - 3 | 1.17 | -13 | 59.7 |
| | 6 months | -1 | 3.79 | ±0 | 2.35 | +1 | 2.78 | -3 | 2.38 | - 4 | 15.6 | -3 | 10.5 | -4 | 15.0 | - 1 | 12.5 | +4 | 1.17 | +1 | 0.107 | + 2 | 6.39 | - 1 | 9.09 | ± 0 | 8.59 | -13 | 60.2 |
| | 1 year | -3 | 6.16 | -1 | 4.17 | ±0 | 4.25 | -5 | 4.51 | - 4 | 17.8 | -5 | 14.9 | -8 | 17.8 | - 4 | 15.0 | ±0 | 2.40 | -1 | 0.967 | ± 0 | 7.18 | - 4 | 11.9 | - 1 | 2.01 | -13 | 60.7 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | -1 | 2.96 | ±0 | 1.72 | ±0 | 1.48 | -3 | 4.71 | - 2 | 5.04 | -2 | 4.66 | ±0 | 4.96 | ± 0 | - 2.73 | ±0 | 2.19 | +2 | 0.921 | + 2 | 1.17 | + 2 | 1.02 | - 1 | 1.25 | -12 | 33.7 |
| | 2 months | -2 | 3.70 | ±0 | 1.66 | ±0 | 2.40 | -5 | 5.18 | - 7 | 12.4 | -4 | 9.42 | -4 | 11.0 | - 4 | 1.18 | -6 | 1.83 | -3 | -0.971 | ± 0 | 0.984 | - 3 | 4.90 | - 2 | 1.68 | -14 | 58.0 |
| | 6 months | -1 | 4.22 | -1 | 2.24 | +2 | 3.08 | -3 | 6.10 | - 6 | 15.1 | -3 | 12.2 | -4 | 11.7 | - 1 | 2.91 | -2 | 1.91 | +1 | 0.186 | + 1 | 1.13 | - 2 | 7.67 | ± 0 | 14.3 | -13 | 58.6 |
| | 1 year | -3 | 6.85 | ±0 | 3.85 | ±0 | 4.60 | -5 | 8.25 | - 7 | 17.5 | -5 | 16.7 | -7 | 18.1 | - 4 | 5.12 | -5 | 3.16 | ±0 | 0.978 | ± 0 | 2.36 | - 4 | 10.5 | - 1 | 1.18 | -13 | 59.1 |
| Silicone Base Fluid Code B | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | -2 | 2.88 | +1 | 1.33 | ±0 | 2.34 | -2 | 3.43 | - 3 | 8.03 | -1 | 3.38 | -1 | 8.32 | + 0 | 11.9 | +1 | 2.06 | -1 | 0.884 | + 1 | 4.13 | - 2 | 7.35 | ± 0 | 14.8 | -12 | 60.5 |
| | 2 months | -4 | 4.13 | -1 | 1.86 | -3 | 2.56 | -5 | 5.48 | - 9 | 14.6 | -3 | 9.28 | -6 | 14.0 | - 7 | 20.2 | -4 | 3.43 | -3 | 0.295 | - 3 | 6.76 | - 7 | 16.0 | - 3 | 3.80 | -14 | 66.0 |
| | 6 months | -2 | 4.41 | -1 | 1.78 | -2 | 3.08 | -4 | 6.39 | - 9 | 17.2 | -3 | 11.9 | -4 | 17.3 | - 1 | 22.8 | -1 | 3.95 | ±0 | -0.295 | ± 0 | 6.96 | - 6 | 21.6 | ± 0 | 3.90 | -13 | 66.4 |
| | 1 year | -4 | 6.49 | -2 | 3.49 | -4 | 4.52 | -7 | 9.00 | -10 | 19.8 | -5 | 16.8 | -7 | 20.0 | - 9 | 25.5 | -2 | 5.33 | -3 | 0.935 | - 2 | 9.00 | - 7 | 20.3 | - 2 | 4.77 | -15 | 67.2 |

[a]Test No. 5 0° F.
[b]Change in hardness (points, Shore D).
[c]Change in volume (percent).

TABLE A-5 (CONT'D)

| Conditions[a] | Time | LPDM (R969) | | FPDM (70 Duro) | | EPDM (80 Duro) | | Natural Rubber (60 Duro) | | SBR (50 Duro) | | SBR (63 Duro) (SAE) | | SBR (70 Duro) | | Viton (70 Duro) | | Neoprene | | Butyl (60 Duro) | | Buna N (60 Duro) 33% ACN | | Buna N (70 Duro) 21% ACN | | Buna N (70 Duro) 41% ACN | | Silicone (60 Duro) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | -2 | 3.65 | +1 | 1.74 | ±0 | 1.04 | -2 | 7.81 | -3 | 7.57 | 1 | 4.42 | -1 | 6.72 | +0 | 2.30 | +1 | 0.03 | -1 | 0.962 | -1 | 3.80 | -2 | 6.88 | ±0 | 3.55 | -12 | 59.4 |
| | 2 months | -4 | 4.65 | ±0 | 2.41 | -3 | 2.36 | -5 | 5.57 | -6 | 15.8 | -3 | 10.7 | -6 | 14.0 | -6 | 20.7 | -5 | 3.15 | ±0 | 0.168 | -3 | 6.27 | -6 | 15.3 | -3 | 4.20 | -14 | 63.4 |
| | 6 months | -2 | 4.85 | ±0 | 2.41 | -2 | 3.15 | -4 | 7.33 | -6 | 21.2 | -3 | 13.3 | -5 | 17.2 | -4 | 25.1 | -4 | 3.76 | +2 | -0.176 | -1 | 6.43 | -6 | 15.3 | -1 | 3.72 | -13 | 64.3 |
| | 1 year | -4 | 6.35 | -2 | 4.17 | -4 | 4.77 | -7 | 9.97 | -8 | 20.2 | -5 | 17.0 | -7 | 19.6 | -8 | 25.9 | -2 | 5.40 | +0 | 3.966 | -1 | 8.81 | -8 | 19.9 | -2 | 4.84 | -15 | 65.1 |
| Silicone Base Fluid Code C | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | -2 | 1.20 | +1 | -2.32 | ±0 | 0.785 | ±0 | 1.88 | -1 | 5.46 | ±0 | 2.63 | -1 | 4.62 | -2 | 28.9 | +0 | 0.043 | ±0 | -1.15 | +2 | 3.73 | -4 | 7.84 | +1 | 1.24 | -10 | 46.6 |
| | 2 months | -2 | 2.35 | ±0 | 0.628 | -2 | 1.04 | -5 | 4.00 | -8 | 11.1 | -3 | 6.50 | -5 | 10.8 | -10 | 58.4 | -4 | 2.20 | -2 | 0.093 | -2 | 5.35 | -12 | 34.3 | -2 | 3.47 | -11 | 53.5 |
| | 6 months | -1 | 0.88 | +2 | -0.139 | ±0 | 0.734 | ±0 | 2.97 | -8 | 16.5 | ±0 | 6.86 | -4 | 11.6 | -10 | 54.1 | -2 | 1.20 | +1 | -0.201 | ±0 | 5.68 | -12 | 41.3 | +1 | 2.21 | -13 | 51.6 |
| | 1 year | d | d | - | ±0 | 0.628 | -2 | 1.40 | -1 | 3.31 | -9 | 14.3 | -1 | 5.31 | -6 | 12.[illegible] | -11 | 51.3 | -6 | 2.74 | ±0 | 0.417 | -2 | 7.60 | -14 | 43.3 | ±0 | 3.26 | -14 | 53.1 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 weeks | -2 | 0.968 | +1 | -2.33 | ±0 | 0.729 | ±0 | 1.85 | -1 | 4.95 | ±0 | 3.53 | -1 | 4.75 | -2 | 30.4 | +0 | 0.192 | ±0 | -1.33 | +2 | 4.20 | -4 | 13.0 | +1 | 2.18 | -10 | 46.4 |
| | 2 months | -3 | 1.70 | +0 | 0.978 | -2 | 1.45 | -2 | 2.88 | -5 | 12.3 | -3 | 7.14 | -6 | 10.3 | -10 | 62.1 | -4 | 2.22 | -3 | 0.143 | -2 | 5.05 | -12 | 33.3 | -1 | 2.33 | -11 | 51.3 |
| | 6 months | -2 | 0.64 | +2 | 0.241 | ±0 | 1.43 | ±0 | 2.04 | -6 | 16.1 | -6 | 9.21 | -4 | 10.9 | -11 | 57.8 | -2 | 2.07 | +0 | 0.032 | -1 | 5.45 | -12 | 40.1 | +1 | 1.74 | -13 | 51.3 |
| | 1 year | d | d | - | -2 | 1.02 | -1 | 1.97 | -1 | 2.37 | -7 | 18.8 | -1 | 5.57 | -6 | 11.9 | -12 | 54.5 | -5 | 2.81 | -1 | 0.625 | -2 | 7.08 | -14 | 44.3 | ±0 | 2.50 | -13 | 52.5 |

[a]Test No. 5 0° F
[b]Change in hardness (points, Shore D).
[c]Change in volume (percent).
[d]Test jar broken.

TABLE A-6. CONTAMINATED FLUIDS (GRADE 10, ENGINE OIL) AMBIENT TEMPERATURE

| Conditions[a] | Time | EPDM (RM69) | | EPDM (70 Duro) | | EPDM (80 Duro) | | Natural Rubber (60 Duro) | | SBR (50 Duro) | | SBR (63 Duro) (SAE) | | SBR (70 Duro) | | Viton (70 Duro) | | Neoprene | | Butyl (60 Duro) | | Buna N (60 Duro) 33% ACN | | Buna N (70 Duro) 22% ACN | | Buna N (70 Duro) 41% ACN | | Silicone (60 Duro) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c |
| Test 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Silicone Base | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Compatibility | 1 week | - 4 | 9.09 | -2 | 4.28 | - 2 | -0.715 | - 7 | 3.55 | - 7 | 8.62 | - 5 | 8.33 | - 5 | 8.63 | -10 | 18.7 | - 8 | 5.71 | - 1 | -0.125 | - 3 | 8.11 | -6 | 12.8 | -6 | 2.66 | -15 | 52.0 |
| Fluid (RM70) | 3 weeks | - 7 | 8.46 | -6 | 5.99 | -15 | 1.24 | - 7 | 4.12 | - 9 | 14.7 | - 7 | 11.8 | - 9 | 16.2 | -12 | 30.2 | - 9 | 7.99 | + 3 | 6.70 | - 6 | 11.4 | -6 | 14.2 | -7 | 3.36 | -15 | 54.7 |
| | 7 weeks | - 5 | 11.2 | -3 | 5.84 | -10 | 0.946 | - 6 | 5.69 | - 9 | 17.3 | - 6 | 17.5 | - 6 | 16.1 | -11 | 40.2 | - 8 | 11.8 | +10 | 8.34 | - 4 | 16.8 | -7 | 16.1 | -5 | 8.13 | -13 | 56.5 |
| | 6 months | - 6 | 12.6 | -2 | 5.94 | -19 | 0.892 | - 6 | 6.3 | - 9 | 17.7 | - 8 | 19.2 | - 8 | 17.6 | - 9 | 46.0 | -10 | 13.9 | + 9 | 9.91 | - 5 | 18.3 | -9 | 16.8 | -6 | 10.10 | -15 | 58.1 |
| | 1 year | - 6 | 12.3 | -3 | 5.86 | -14 | 1.48 | - 7 | 5.70 | -10 | 17.2 | - 8 | 18.2 | - 9 | 16.5 | -14 | 46.1 | -10 | 12.2 | + 7 | 9.81 | - 6 | 18.2 | -7 | 16.2 | -7 | 10.25 | -16 | 58.6 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | - 5 | 3.45 | -2 | 3.63 | ± 0 | 2.36 | - 7 | 12.4 | - 9 | 10.5 | - 5 | 11.5 | - 5 | 9.06 | -10 | 20.1 | - 7 | 7.56 | - 4 | -0.457 | - 3 | 7.41 | -6 | 10.3 | -6 | 3.41 | -15 | 50.7 |
| | 3 weeks | - 7 | 6.69 | -6 | 8.39 | -13 | 4.52 | - 7 | 14.7 | - 9 | 22.5 | - 8 | 15.5 | - 9 | 14.0 | -12 | 28.6 | - 9 | 10.0 | + 8 | 12.0 | - 6 | 14.5 | -6 | 14.0 | -8 | 4.30 | -16 | 54.9 |
| | 7 weeks | - 4 | 6.44 | -3 | 5.86 | -10 | -5.80 | - 6 | 14.9 | - 7 | 17.0 | - 6 | 17.3 | - 6 | 15.6 | -10 | 37.4 | - 9 | 11.8 | +11 | 13.5 | - 4 | 17.3 | -6 | 21.6 | -4 | 6.76 | -13 | 56.9 |
| | 6 months | - 6 | 7.71 | -3 | 6.32 | -11 | -4.19 | - 6 | 16.7 | - 9 | 17.8 | - 9 | 18.8 | - 9 | 17.0 | -10 | 47.7 | -10 | 14.9 | +11 | 14.0 | - 5 | 18.5 | -9 | 16.8 | -7 | 9.11 | -15 | 57.7 |
| | 1 year | - 6 | 8.38 | -4 | 6.45 | -13 | -3.84 | - 7 | 15.4 | -10 | 16.6 | - 8 | 17.7 | - 9 | 15.9 | -14 | 45.5 | -10 | 13.4 | + 9 | 14.4 | - 6 | 18.5 | -7 | 15.9 | -7 | 9.60 | -16 | 58.1 |
| Conventional | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Compatibility | 1 week | - 3 | 2.06 | -4 | 0.57 | - 1 | -0.655 | - 2 | 4.17 | - 2 | 5.66 | - 3 | 3.33 | - 2 | 3.30 | -21 | 124.0 | - 7 | 6.46 | ± 0 | 1.15 | - 9 | 42.7 | -8 | 20.5 | -9 | 36.8 | - 1 | 0.462 |
| Fluid (RM66-06) | 3 weeks | - 5 | 6.21 | -6 | 8.32 | - 2 | 2.05 | - 4 | 5.84 | - 6 | 6.52 | - 3 | 4.62 | - 3 | 6.71 | -27 | 174.0 | -10 | 4.94 | - 2 | 2.60 | -11 | 45.3 | -9 | 19.2 | -9 | 35.6 | - 3 | 0.298 |
| | 7 weeks | - 6 | 10.1 | -3 | 9.96 | - 2 | 6.58 | - 3 | 7.10 | - 4 | 7.78 | - 3 | 9.52 | - 4 | 7.64 | -34 | 207.0 | - 6 | 4.14 | - 1 | 7.47 | - 8 | 33.0 | -5 | 8.71 | -7 | 23.1 | ± 0 | 2.16 |
| | 6 months | - 7 | 13.8 | -4 | 12.10 | - 3 | 8.85 | - 3 | 9.60 | - 5 | 10.90 | - 3 | 11.70 | - 3 | 9.16 | -36 | 213.0 | - 2 | 1.74 | - 1 | 10.60 | - 6 | 19.2 | ±0 | 1.39 | -4 | 10.3 | + 1 | 3.40 |
| | 1 year | - 7 | 14.4 | -3 | 12.12 | - 4 | 9.99 | - 3 | 8.40 | - 3 | 9.20 | - 4 | 12.45 | - 4 | 8.06 | -37 | 203.0 | - 4 | 0.53 | ± 0 | 11.10 | - 5 | 15.7 | -2 | 1.14 | -5 | 8.9 | - 1 | 2.70 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | - 3 | 1.85 | -4 | 3.88 | ± 0 | 2.54 | - 2 | 3.79 | - 2 | 5.41 | - 3 | 3.12 | - 3 | 4.51 | -23 | 111.0 | - 5 | 5.59 | + 2 | 0.452 | - 9 | 45.1 | -8 | 20.1 | -8 | 35.5 | ± 0 | 0.094 |
| | 3 weeks | - 4 | 5.84 | -6 | 8.66 | - 2 | 5.42 | - 5 | 6.02 | - 6 | 7.97 | - 3 | 6.04 | - 3 | 9.18 | -27 | 179.0 | -10 | 4.94 | - 2 | 2.20 | -11 | 45.8 | -8 | 18.2 | -9 | 33.0 | - 3 | 3.41 |
| | 7 weeks | - 6 | 11.7 | -4 | 10.20 | - 2 | 9.43 | - 2 | 7.10 | - 2 | 9.61 | - 3 | 9.50 | - 4 | 8.36 | -34 | 212.0 | - 6 | 3.77 | ± 0 | 6.13 | - 8 | 31.1 | -3 | 7.38 | -6 | 22.8 | - 1 | 3.11 |
| | 6 months | - 6 | 14.1 | -4 | 12.30 | - 5 | 14.1 | - 3 | 10.60 | - 3 | 10.40 | - 4 | 12.70 | - 3 | 9.11 | -38 | 219.0 | - 1 | 1.42 | - 1 | 9.41 | - 5 | 19.6 | ±0 | -0.18 | -4 | 10.0 | + 1 | 3.54 |
| | 1 year | - 7 | 15.3 | -3 | 12.03 | - 4 | 13.6 | - 3 | 8.57 | - 3 | 10.58 | - 4 | 13.06 | - 4 | 9.72 | -37 | 202.4 | - 4 | 0.54 | ± 0 | 10.70 | - 4 | 16.8 | -2 | -0.14 | -5 | 11.2 | - 1 | 7.40 |
| Test 6a | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Silicone Base | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Compatibility | 1 week | - 7 | 9.56 | -3 | 8.97 | - 2 | 7.18 | - 7 | 12.8 | - 7 | 14.7 | - 7 | 13.1 | - 5 | 6.60 | - 6 | 12.9 | - 6 | 8.78 | + 2 | 3.59 | - 4 | 7.23 | -6 | 12.8 | -6 | 4.25 | -13 | 56.2 |
| Fluid (RM70) | 3 weeks | - 9 | 15.7 | -7 | 12.2 | - 6 | 13.8 | -10 | 22.2 | - 9 | 17.8 | -10 | 22.8 | -10 | 20.7 | - 7 | 22.7 | - 7 | 9.80 | ± 0 | 4.61 | - 4 | 9.85 | -7 | 14.4 | -8 | 3.73 | -15 | 57.6 |
| | 7 weeks | - 9 | 18.4 | -7 | 23.2 | - 5 | 18.0 | - 9 | 23.9 | - 9 | 26.9 | - 8 | 24.7 | - 9 | 23.0 | - 8 | 32.1 | -10 | 13.5 | + 2 | 5.63 | - 4 | 15.4 | -7 | 14.7 | -6 | 6.08 | -14 | 67.3 |
| | 6 months | -10 | 25.1 | -9 | 26.1 | - 7 | 22.1 | - 9 | 27.7 | - 9 | 29.3 | - 9 | 27.7 | -10 | 25.2 | - 9 | 42.9 | - 9 | 18.4 | + 1 | 10.10 | - 5 | 17.3 | -6 | 14.5 | -7 | 7.90 | -13 | 59.8 |
| | 1 year | -10 | 24.5 | -8 | 25.7 | - 8 | 22.0 | - 9 | 25.8 | -10 | 28.8 | -10 | 26.6 | - 9 | 24.4 | -11 | 41.9 | -10 | 17.6 | - 1 | 11.60 | - 5 | 16.4 | -7 | 14.3 | -6 | 8.19 | -14 | 60.9 |

See footnotes at end of table.

TABLE A-6. (CONT'D)

| Conditions[a] | Time | EPDM (RX69) | | EPDM (70 Duro) | | EPDM (80 Duro) | | Natural Rubber (60 Duro) | | SBR (50 Duro) | | SBR (63 Duro) (SAF) | | SBR (70 Duro) | | Viton (70 Duro) | | Neoprene | | Butyl (60 Duro) | | Buna N (60 Duro) 33% ACN | | Buna N (70 Duro) 21% ACN | | Buna N (70 Duro) 41% ACN | | Silicone (60 Duro) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | - 6 | 7.54 | - 3 | 5.41 | - 2 | 6.46 | - 6 | 20.5 | - 7 | 10.1 | - 6 | 10.0 | - 5 | 13.3 | - 4 | 17.2 | - 4 | 7.16 | +1 | 2.06 | - 4 | 8.05 | -6 | 4.40 | - 6 | 5.33 | -13 | 55.2 |
| | 3 weeks | - 9 | 18.0 | - 7 | 13.2 | - 6 | 15.4 | -10 | 27.7 | - 9 | 20.7 | -10 | 20.6 | -10 | 17.5 | - 7 | 24.9 | - 7 | 9.90 | ±0 | 1.89 | - 4 | 11.4 | -7 | 14.8 | - 8 | 6.66 | -15 | 57.1 |
| | 7 weeks | - 8 | 17.3 | - 7 | 20.2 | - 6 | 17.6 | - 9 | 37.7 | - 8 | 25.2 | - 7 | 23.8 | - 9 | 23.5 | - 8 | 33.5 | - 8 | 12.4 | ±0 | 3.88 | - 4 | 13.9 | -6 | 14.5 | - 6 | 6.82 | -13 | 57.7 |
| | 6 months | -10 | 24.8 | - 9 | 24.4 | - 7 | 20.3 | - 9 | 29.1 | - 9 | 28.1 | - 9 | 27.4 | - 9 | 25.0 | - 9 | 40.1 | -10 | 17.1 | -3 | 7.75 | - 5 | 16.9 | -6 | 15.2 | - 6 | 8.48 | -15 | 59.9 |
| | 1 year | -10 | 24.5 | - 8 | 24.0 | - 8 | 20.5 | - 9 | 28.4 | - 9 | 27.5 | -10 | 26.6 | -10 | 24.9 | -11 | 41.2 | -11 | 15.8 | -3 | 9.62 | - 5 | 15.8 | -7 | 14.4 | - 6 | 7.76 | -15 | 60.5 |
| Conventional Compatibility Fluid (RX66-06) | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | - 7 | 10.5 | - 5 | 6.68 | - 4 | 7.97 | - 2 | 8.46 | - 7 | 8.36 | - 4 | 21.6 | - 4 | 6.61 | -11 | 128.0 | - 8 | 7.89 | -2 | 2.74 | -11 | 43.6 | -6 | 20.3 | -12 | 33.7 | - 5 | 5.01 |
| | 3 weeks | - 8 | 14.0 | - 5 | 13.3 | - 6 | 11.2 | -10 | 24.4 | - 9 | 15.4 | - 7 | 29.0 | - 9 | 17.3 | -27 | 178.0 | -11 | 10.1 | -5 | 4.73 | -11 | 48.7 | -7 | 21.8 | -14 | 41.2 | - 5 | 8.89 |
| | 7 weeks | -11 | 49.3 | - 7 | 25.5 | - 9 | 31.2 | -11 | 53.6 | - 8 | 27.9 | - 8 | 41.7 | - 9 | 26.7 | -32 | 227.0 | - 8 | 8.51 | -4 | 23.3 | - 9 | 38.4 | -3 | 12.0 | -11 | 32.5 | - 2 | 6.45 |
| | 6 months | -15 | 69.9 | -13 | [d] - | -15 | 50.7 | -13 | 56.0 | -11 | 32.9 | - 8 | 32.1 | - 9 | 29.3 | -44 | 265.0 | - 5 | 6.07 | -8 | 39.5 | - 8 | 24.0 | -1 | 5.[illegible] | -11 | 25.2 | - 1 | 6.88 |
| | 1 year | -16 | [d] - | -14 | [d] - | -12 | 56.2 | -12 | 51.3 | -13 | 36.9 | -11 | 52.6 | - 9 | 32.7 | -44 | 255.8 | - 5 | 5.57 | -8 | 50.0 | - 9 | 26.9 | -3 | 4.[illegible] | -11 | 23.9 | - 3 | 7.11 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | - 8 | 8.61 | - 5 | 5.67 | - 4 | 6.49 | - 2 | 8.31 | - 7 | 10.5 | - 3 | 10.1 | - 4 | 9.03 | -21 | 126.0 | - 8 | 7.29 | -2 | 3.36 | -11 | 40.6 | -6 | 22.7 | -12 | 40.0 | - 5 | 5.89 |
| | 3 weeks | - 8 | 11.9 | - 5 | 14.1 | - 6 | 14.0 | -10 | 29.7 | - 9 | 17.7 | - 7 | 18.2 | - 9 | 17.0 | -27 | 181.0 | -11 | 9.70 | -5 | 4.21 | -11 | 50.7 | -7 | 23.4 | -14 | 39.8 | - 5 | 6.66 |
| | 7 weeks | -11 | 32.0 | -10 | 39.5 | - 5 | 25.8 | - 9 | 27.3 | -10 | 30.3 | - 8 | 27.2 | - 9 | 23.5 | -35 | 238.0 | - 8 | 7.04 | -4 | 21.3 | - 9 | 38.2 | -5 | 14.3 | -11 | 33.0 | - 2 | 6.89 |
| | 6 months | -17 | 73.4 | -15 | [d] - | -10 | 43.0 | -11 | 46.6 | -12 | 36.3 | -10 | 36.6 | -10 | 30.7 | -44 | 266.0 | - 5 | 5.15 | -7 | 29.7 | - 8 | 28.5 | -3 | 6.99 | -11 | 25.1 | - 1 | 6.67 |
| | 1 year | -16 | [d] - | 15 | [d] - | -11 | 56.9 | -12 | 57.2 | -13 | 39.7 | -11 | 39.3 | -11 | 34.6 | -44 | 250.7 | - 5 | 4.44 | -6 | 36.7 | - 9 | 26.4 | -3 | 5.82 | -11 | 23.6 | - 3 | 6.97 |

[a] Ambient temperature, test No. 6 silicone fluid with 1% 10 wt oil.
[b] Change in hardness (point, Shore D).
[c] Change in volume (percent).
[d] Sample floated.

TABLE A-7. CONTAMINATED FLUID (SHOCK ASSORBER FLUID) AMBIENT TEMPERATURE

| Conditions[a] | Time | FPDM (Rm69) | | EPDM (70 Duro) | | EPDM (80 Duro) | | Natural Rubber (60 Duro) | | SBR (50 Duro) | | SBR (63 Duro) (SAE) | | SBR (70 Duro) | | Viton (70 Duro) | | Neoprene | | Butyl (60 Duro) | | Buna N (60 Duro) 33% ACN | | Buna N (70 Duro) 21% ACN | | Buna N (70 Duro) 41% ACN | | Silicone (60 Duro) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c |
| Test 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Silicone | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Base | 1 week | - 5 | 3.95 | - 2 | 6.05 | - 2 | 3.10 | - 4 | 11.1 | - 4 | 11.3 | - 3 | 9.07 | - 2 | 6.32 | - 7 | 18.5 | - 5 | 3.14 | +2 | 3.79 | - 4 | 7.79 | - 6 | 10.1 | - 3 | 3.32 | -13 | 53.8 |
| Compatibility | 3 weeks | - 4 | 6.01 | - 4 | 6.93 | - 4 | 5.79 | - 7 | 15.3 | - 8 | 16.5 | - 7 | 14.9 | - 6 | 14.2 | - 9 | 30.0 | -10 | 7.80 | +1 | 1.63 | - 6 | 13.0 | - 6 | 14.9 | - 4 | 5.58 | -14 | 56.7 |
| Fluid | 7 weeks | - 4 | 9.14 | - 6 | 6.58 | - 2 | 5.37 | - 5 | 15.1 | - 5 | 16.3 | - 5 | 15.8 | - 6 | 1.52 | -11 | 42.4 | - 9 | 10.7 | -4 | 0.509 | - 4 | 17.0 | - 6 | 16.0 | - 3 | 8.38 | -13 | 56.4 |
| (RM 70) | 6 months | - 6 | 6.90 | - 3 | 7.38 | - 2 | 7.04 | - 4 | 15.9 | - 7 | 17.7 | - 7 | 18.6 | - 7 | 16.9 | -12 | 50.4 | -10 | 12.8 | +4 | 2.35 | - 6 | 17.8 | - 7 | 17.3 | - 3 | 10.50 | -13 | 59.7 |
| | 1 year | - 5 | 7.08 | - 4 | 6.80 | - 3 | 7.28 | - 6 | 14.9 | - 7 | 17.1 | - 8 | 18.3 | - 8 | 16.4 | -13 | 48.9 | -10 | 11.7 | +2 | 2.81 | - 6 | 18.8 | - 7 | 16.9 | - 3 | 10.60 | -15 | 59.5 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | - 5 | 2.44 | - 2 | 2.80 | - 1 | 2.74 | - 4 | 6.43 | - 4 | 6.18 | - 3 | 11.6 | - 2 | 9.90 | - 6 | 23.9 | - 5 | 5.16 | +2 | - 0.462 | - 4 | 7.09 | - 5 | 12.8 | - 4 | 4.37 | -14 | 52.5 |
| | 3 weeks | - 4 | 0.727 | - 4 | 5.69 | - 4 | 5.75 | - 7 | 14.4 | - 8 | 16.6 | - 7 | 16.6 | - 6 | 16.3 | - 9 | 31.5 | -10 | 9.42 | +1 | 0.839 | - 6 | 14.8 | - 6 | 15.6 | - 4 | 5.46 | -14 | 56.8 |
| | 7 weeks | - 4 | 2.07 | - 6 | 6.33 | - 2 | 3.93 | - 6 | 14.9 | - 7 | 17.0 | - 5 | 16.2 | - 7 | 15.0 | -11 | 39.7 | - 8 | 9.09 | +2 | - 0.423 | - 5 | 17.0 | - 6 | 16.1 | - 2 | 7.45 | -13 | 56.0 |
| | 6 months | - 5 | 1.29 | - 3 | 6.76 | - 1 | 6.32 | - 4 | 15.6 | -11 | 17.9 | - 8 | 17.8 | - 8 | 17.0 | -11 | 47.6 | - 9 | 11.[illegible] | +2 | 2.11 | - 6 | 18.3 | - 7 | 16.7 | - 2 | 9.93 | -13 | 59.2 |
| | 1 year | - 5 | 1.68 | - 4 | 6.90 | - 3 | 6.77 | - 7 | 15.4 | - 8 | 17.1 | - 8 | 17.5 | - 8 | 16.0 | -13 | 48.8 | -10 | 11.54 | +2 | 3.21 | - 6 | 17.7 | - 7 | 15.7 | - 3 | 10.38 | -15 | 59.9 |
| Conventional | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Compatibility | 1 week | - 2 | 1.85 | - 1 | 3.18 | ± 0 | 3.24 | - 3 | 2.98 | - 3 | 4.12 | - 2 | 5.75 | - 2 | 5.81 | -22 | 126.0 | - 5 | 6.90 | +2 | 0.232 | -11 | 41.7 | - 8 | 22.4 | -10 | 34.6 | + 1 | 1.70 |
| Fluid | 3 weeks | - 5 | 6.69 | - 4 | 7.40 | ± 0 | 3.10 | - 4 | 7.93 | - 4 | 6.54 | - 3 | 7.28 | - 5 | 8.64 | -26 | 179.0 | - 7 | 6.12 | ±0 | 1.31 | -12 | 42.1 | - 9 | 16.7 | -11 | 33.9 | ± 0 | 1.39 |
| (RM 66-06) | 7 weeks | - 6 | 10.2 | - 3 | 11.2 | - 1 | 8.87 | - 2 | 10.5 | - 3 | 8.96 | - 2 | 11.9 | - 4 | 14.30 | -44 | 248.0 | - 4 | 4.52 | +1 | 3.65 | - 6 | 28.5 | - 1 | 6.38 | - 8 | 23.7 | - 1 | 5.90 |
| | 6 months | - 5 | 10.9 | - 4 | 12.4 | - 2 | 9.58 | - 3 | 11.1 | - 4 | 8.16 | - 2 | 10.3 | - 3 | 9.84 | -46 | 271.0 | - 2 | 3.55 | -1 | 6.51 | - 4 | 14.6 | + 1 | - 0.58 | - 4 | 11.0 | - 1 | 6.54 |
| | 1 year | - 6 | 12.5 | - 4 | 12.4 | - 3 | 10.60 | - 4 | 11.2 | - 4 | 9.04 | - 3 | 11.8 | - 4 | 11.62 | -42 | 247.0 | - 3 | 4.69 | -1 | 8.50 | - 8 | 16.5 | - 1 | 2.24 | - 2 | 14.1 | - 1 | 7.92 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | - 2 | 2.99 | ± 0 | 1.24 | ± 0 | 1.35 | - 3 | 2.29 | - 3 | 3.61 | - 2 | 11.7 | - 2 | 4.37 | -22 | 126.0 | - 5 | 5.33 | +2 | 2.18 | -12 | 43.8 | - 0 | 21.4 | -10 | 40.7 | + 1 | 1.73 |
| | 3 weeks | - 5 | 6.44 | - 4 | 5.19 | ± 0 | 3.04 | - 4 | 4.96 | - 4 | 7.39 | - 3 | 7.77 | - 5 | 8.33 | -26 | 184.0 | - 7 | 5.79 | ±0 | 0.550 | -12 | 44.2 | - 9 | 15.6 | -11 | 36.1 | ± 0 | 1.51 |
| | 7 weeks | - 4 | 9.40 | - 3 | 9.20 | ± 0 | 6.62 | - 3 | 7.56 | ± 0 | 8.76 | - 2 | 9.91 | - 3 | 9.79 | -44 | 230.0 | - 6 | 4.68 | +3 | 6.90 | - 5 | 30.3 | - 2 | 5.53 | - 7 | 25.2 | - 1 | 6.01 |
| | 6 months | - 5 | 9.77 | - 2 | 10.60 | - 2 | 7.91 | - 2 | 8.72 | ± 0 | 7.39 | - 3 | 9.82 | - 3 | 8.45 | -46 | 245.0 | - 3 | 2.25 | -1 | 9.06 | - 5 | 16.1 | + 1 | - 1.58 | - 5 | 12.2 | - 1 | 6.47 |
| | 1 year | - 6 | 12.37 | - 4 | 11.37 | - 3 | 9.67 | - 4 | 9.63 | - 3 | 8.15 | - 3 | 10.70 | - 4 | 9.72 | -42 | 221.0 | - 4 | 4.21 | +1 | 11.90 | - 8 | 19.3 | - 1 | 0.18 | - 7 | 15.4 | - 1 | 7.40 |
| Test 7A | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Silicone | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Base | 1 week | - 4 | 6.81 | - 2 | 1.56 | - 1 | 1.66 | - 3 | 12.1 | - 4 | 10.8 | - 6 | 13.0 | - 6 | 14.6 | - 8 | 13.5 | - 8 | 5.52 | +2 | 1.94 | - 3 | 7.22 | - 5 | 9.50 | - 3 | 2.86 | -14 | 5..9 |
| Compatibility | 3 weeks | - 8 | 13.1 | - 6 | 14.9 | - 6 | 11.8 | - 8 | 22.2 | - 9 | 23.6 | - 8 | 23.3 | -10 | 25.7 | - 9 | 18.8 | -10 | 18.4 | +1 | 2.41 | - 3 | 10.5 | - 6 | 15.6 | - 3 | 4.10 | -15 | 57.0 |
| Fluid | 7 weeks | - 7 | 7.59 | - 7 | 18.8 | - 5 | 16.5 | - 9 | 26.4 | - 9 | 30.6 | -10 | 27.2 | - 6 | 13.6 | - 9 | 29.7 | -10 | 15.8 | -4 | 5.34 | - 4 | 15.4 | - 4 | 13.2 | -15 | 3.80 | -14 | 51.5 |
| (RM 70) | 6 months | - 8 | 8.02 | - 7 | 20.1 | - 5 | 17.5 | - 9 | 28.2 | - 9 | 30.9 | -10 | 24.1 | -10 | 14.5 | -12 | 41.8 | -12 | 16.7 | +1 | 7.90 | - 5 | 15.2 | - 7 | 13.5 | - 3 | 3.95 | -15 | 55.0 |
| | 1 year | - 9 | 8.16 | - 7 | 19.9 | - 6 | 17.6 | -10 | 27.6 | -11 | 30.9 | -11 | 23.9 | -11 | 14.0 | -13 | 40.3 | -13 | 15.6 | ±0 | 9.61 | - 5 | 29.2 | - 8 | 12.9 | - 3 | 4.23 | -16 | 55.2 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | - 4 | 8.73 | - 2 | 5.93 | - 1 | 5.44 | - 3 | 13.1 | - 5 | 16.3 | - 5 | 16.3 | - 6 | 17.9 | - 8 | 14.3 | - 8 | 4.72 | +2 | 1.71 | - 2 | 6.21 | - 4 | 11.0 | - 3 | 3.73 | -14 | 53.6 |
| | 3 weeks | - 8 | 15.4 | - 6 | 14.5 | - 6 | 12.9 | - 8 | 23.4 | - 9 | 27.2 | - 8 | 27.1 | -10 | 24.9 | - 9 | 20.8 | -10 | 11.7 | +1 | 2.76 | - 5 | 11.5 | - 6 | 14.0 | - 3 | 4.37 | -15 | 57.2 |
| | 7 weeks | - 7 | 24.4 | - 7 | 18.8 | - 5 | 16.7 | - 9 | 27.3 | - 9 | 31.0 | -10 | 37.3 | - 7 | 18.2 | - 9 | 35.4 | -10 | 21.2 | -9 | 5.11 | - 4 | 9.76 | - 7 | 26.0 | - 4 | 3.00 | -13 | 53.6 |
| | 6 months | - 8 | 25.2 | - 7 | 19.2 | - 5 | 17.2 | -10 | 27.9 | - 9 | 27.4 | -10 | 38.8 | -10 | 18.9 | -12 | 41.8 | -12 | 23.1 | -1 | 7.59 | - 5 | 5.06 | - 7 | 25.6 | - . | 29.8 | -15 | 73.3 |
| | 1 year | - 9 | 25.2 | - 8 | 19.2 | - 7 | 18.0 | -10 | 28.0 | -11 | 31.6 | - 9 | 38.2 | -11 | 18.4 | -13 | 42.7 | -12 | 21.7 | ±0 | 9.27 | - 5 | 5.31 | - 7 | 24.6 | - 3 | 29.63 | -16 | 73.5 |

See footnotes at end of table.

TABLE A-7 (CONT'D)

| Conditions[a] | Time | EPDM (RM69) | | EPDM (70 Duro) | | EPDM (80 Duro) | | Natural Rubber (60 Duro) | | SBR (50 Duro) | | SBR (63 Duro) (SF-1) | | SBR (70 Duro) | | Viton (70 Duro) | | Neoprene | | Butyl (60 Duro) | | Buna N (60 Duro) 33% ACN | | Buna N (70 Duro) 21% ACN | | Buna N (70 Duro) 41% ACN | | Silicone (60 Duro) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c |
| Conventional Compatibility Fluid (RM 66-06) | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | - 4 | 5.25 | - 6 | 11.4 | - 2 | 3.28 | - 3 | 8.04 | - 6 | 8.66 | - 3 | 8.37 | - 4 | 9.12 | -22 | 138 | - 7 | 8.04 | -1 | 1.56 | -12 | 43.4 | -11 | 28.4 | - 9 | 35.9 | - 3 | 5.03 |
| | 3 weeks | - 5 | 7.93 | - 8 | 16.1 | - 4 | 8.14 | - 4 | 13.2 | - 7 | 18.7 | - 5 | 13.6 | - 8 | 14.4 | -26 | 189 | -10 | 10.7 | -2 | 4.68 | -12 | 48.3 | -11 | 22.2 | -10 | 38.6 | - 3 | 6.25 |
| | 7 weeks | -10 | 27.7 | -12 | 40.6 | - 8 | 27.1 | - 8 | 34.7 | -10 | 29.7 | -10 | 41.2 | -10 | 29.1 | -34 | 228 | -11 | 14.1 | -4 | 21.1 | - 9 | 33.3 | - 6 | 12.8 | - 6 | 27.0 | - 3 | 10.6 |
| | 6 months | -16 | 56.6 | -16 | 72.4 | -12 | 47.4 | -12 | 56.0 | -16 | 53.1 | -13 | 57.8 | -12 | 38.5 | -44 | 268 | -10 | 12.2 | -8 | 44.5 | - 8 | 20.3 | - 3 | 1.8 | - 6 | 16.8 | - 3 | 10.5 |
| | 1 year | d | d | -17 | - | -14 | 58.6 | -15 | 48.5 | -17 | 63.3 | -14 | 67.9 | -15 | 52.9 | -34 | 233 | -11 | 12.6 | -9 | 51.7 | - 8 | 20.0 | - 4 | 6.1 | - 7 | 17.2 | - 3 | 11.0 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | - 4 | 3.72 | - 6 | 6.65 | - 2 | 3.54 | - 3 | 9.31 | - 6 | 10.9 | - 3 | 9.99 | - 4 | 10.4 | -22 | 133 | - 7 | 8.54 | -1 | 3.56 | -12 | 38.5 | -11 | 23.4 | -10 | 40.0 | - 3 | 4.37 |
| | 3 weeks | - 5 | 12.0 | - 8 | 17.9 | - 4 | 11.2 | - 4 | 14.8 | - 7 | 15.4 | - 5 | 16.7 | - 8 | 17 9 | -26 | 188 | -10 | 11.4 | -2 | 6.02 | -12 | 47.1 | -11 | 25.3 | -10 | 38.3 | - 3 | 5.72 |
| | 7 weeks | -10 | 56.4 | -12 | 70.3 | - 9 | 21.6 | - 8 | 28.5 | -10 | 26.6 | -10 | 33.2 | - 9 | 23.8 | -39 | 225 | -11 | 15.0 | -3 | 17.1 | - 6 | 32.6 | - 6 | 12.3 | - 5 | 27.0 | - 3 | 10.3 |
| | 6 months | -16 | 63.2 | -15 | 79.7 | -10 | 40.2 | -12 | 67.3 | -18 | 67.5 | -12 | 49.8 | -12 | 41.2 | -44 | 235 | -10 | 12.7 | -6 | 34.0 | - 5 | 20.1 | - 3 | 4.9 | - 5 | 17.2 | - 3 | 9.8 |
| | 1 year | d | d | -17 | - | -14 | 51.7 | -15 | 62.3 | -18 | 66.1 | -14 | 61.7 | -15 | 52.9 | -34 | 234 | -11 | 12.8 | -8 | 53.2 | - 7 | 20.1 | - 4 | 5.2 | - 6 | 17.8 | - 3 | 11.1 |

[a]Ambient temperature, test No. 7 silicone fluid with 1% shockoil. Test 7A silicone fluid with 5% shockoil.
[b]Change in hardness (points, Shore D).
[c]Change in volume (percent).
[d]Sample floated.

TABLE A-8. CONTAMINATED FLUID (HYDRAULIC FLUID) AMBIENT TEMPERATURE

| Conditions[a] | Time | EPDM (RM69) | | EPDM (70 Duro) | | EPDM (80 Duro) | | Natural Rubber (60 Duro) | | SBR (50 Duro) | | SBR (63 Duro) (SAE) | | SBR (70 Duro) | | Viton (70 Duro) | | Neoprene | | Butyl (60 Duro) | | Buna N (60 Duro) 33% ACN | | Buna N (70 Duro) 21% ACN | | Buna N (70 Duro) 41% ACN | | Silicone (60 Duro) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c |
| Silicone Base Compatibility Fluid (RM 70) | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | - 7 | 14.2 | - 8 | 16.2 | - 8 | 12.9 | -10 | 9.31 | - 8 | 19.6 | - 7 | 16.3 | - 9 | 15.4 | - 4 | 13.4 | - 6 | 9.61 | - 2 | 3.15 | - 2 | 5.37 | - 5 | 10.9 | -2 | 1.59 | -13 | 57.7 |
| | 3 weeks | -10 | 21.9 | - 8 | 22.4 | - 8 | 20.1 | -11 | 20.8 | -10 | 30.5 | - 7 | 26.0 | - 9 | 23.9 | - 7 | 19.6 | - 7 | 29.1 | - 3 | 8.39 | - 2 | 17.9 | - 7 | 19.8 | -2 | 8.84 | -13 | 68.1 |
| | 2 months | - 5 | 17.4 | - 6 | 17.2 | - 5 | 17.1 | -11 | 14.8 | - 7 | 22.6 | - 6 | 19.2 | - 6 | 27.2 | - 6 | 23.3 | - 5 | 13.9 | - 1 | 7.33 | - 3 | 13.4 | - 4 | 15.4 | ±0 | 5.55 | -11 | 55.7 |
| | 6 months | - 6 | 17.1 | - 6 | 17.0 | - 6 | 17.0 | - 9 | 13.9 | - 7 | 20.5 | - 7 | 18.8 | - 7 | 17.3 | - 9 | 27.3 | - 4 | 12.9 | - 2 | 9.38 | - 3 | 13.3 | - 5 | 12.8 | ±0 | 4.82 | -11 | 62.0 |
| | 1 year | - 6 | 16.9 | - 5 | 17.6 | - 7 | 17.6 | - 8 | 13.1 | - 6 | 21.7 | - 6 | 17.9 | - 7 | 15.8 | - 9 | 27.9 | - 5 | 12.2 | - 1 | 10.80 | - 2 | 13.5 | - 4 | 11.5 | ±0 | 5.10 | - 9 | 61.6 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | | | - 8 | 13.6 | - 9 | 14.1 | -10 | 20.6 | - 8 | 24.2 | - 6 | 11.5 | - 8 | 11.7 | - 4 | 7.59 | - 6 | 7.64 | - 3 | 2.64 | - 2 | 9.26 | - 5 | 8.14 | -2 | 3.58 | -13 | 58.1 |
| | 3 weeks | | | - 8 | 21.7 | - 8 | 15.2 | -11 | 15.8 | - 9 | 29.6 | - 7 | 25.5 | - 9 | 23.9 | - 6 | 22.4 | - 7 | 15.4 | - 1 | 11.9 | ± 0 | 33.9 | - 7 | 18.5 | -2 | 14.8 | -13 | 69.1 |
| | 2 months | - 4 | 16.3 | - 5 | 16.1 | - 5 | 16.1 | -10 | 22.4 | - 7 | 23.6 | - 6 | 18.4 | - 6 | 30.7 | - 7 | 24.3 | - 5 | 10.1 | - 1 | 7.14 | - 2 | 17.2 | - 4 | 14.4 | ±0 | 7.73 | -11 | 41.5 |
| | 6 months | - 6 | 16.0 | - 6 | 20.5 | - 5 | 15.8 | - 9 | 21.8 | - 7 | 23.5 | - 6 | 17.7 | - 7 | 17.4 | - 8 | 27.3 | - 4 | 9.1 | - 2 | 9.14 | - 3 | 14.6 | - 4 | 11.5 | +1 | 6.63 | -11 | 63.0 |
| | 1 year | - 5 | 13.8 | - 5 | 16.0 | - 7 | 15.4 | - 8 | 21.4 | - 6 | 22.2 | - 6 | 17.1 | - 7 | 16.3 | - 8 | 28.8 | - 5 | 8.5 | - 1 | 10.3 | - 1 | 15.5 | - 4 | 10.1 | ±0 | 5.10 | - 9 | 62.3 |
| Conventional Compatibility Fluid (RM 66-06) | Sample 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | -14 | 16.4 | - 6 | 33.7 | -10 | 39.6 | -15 | 32.2 | -11 | 31.6 | - 7 | 60.3 | -12 | 20.4 | -22 | 137.0 | -13 | 24.4 | - 8 | 27.4 | -10 | 19.7 | -15 | 70.9 | -6 | 27.2 | - 9 | 27.6 |
| | 3 weeks | -10 | 44.8 | - 8 | 50.5 | -10 | 40.8 | -10 | 36.3 | -10 | 35.3 | - 8 | 42.2 | -10 | 34.1 | -24 | 168.0 | -10 | 27.3 | - 5 | 33.8 | - 8 | 49.9 | - 8 | 18.8 | -5 | 29.3 | - 9 | 35.9 |
| | 2 months | -12 | 50.2 | - 8 | 57.8 | -11 | 50.2 | -12 | 43.1 | -13 | 39.6 | -10 | 50.7 | -12 | 42.7 | -26 | 186.0 | -13 | 30.3 | - 8 | 44.5 | - 8 | 22.0 | - 5 | 9.09 | -4 | 16.2 | -12 | 43.7 |
| | 6 months | -12 | 50.6 | - 9 | 54.4 | -12 | 50.3 | -15 | 45.9 | -14 | 42.8 | -10 | 50.2 | -13 | 48.0 | -34 | 203.0 | -13 | 27.6 | - 9 | 50.1 | - 8 | 20.5 | - 5 | 3.95 | -3 | 14.4 | -11 | 42.2 |
| | 1 year | -11 | 48.7 | - 8 | 50.8 | -11 | 47.1 | -12 | 45.9 | -11 | 40.7 | - 9 | 50.6 | - 2 | 42.9 | -30 | 149.4 | -12 | 29.9 | - 7 | 52.6 | - 7 | 24.4 | - 5 | 4.00 | -3 | 14.9 | -10 | 40.9 |
| | Sample 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1 week | -14 | 28.9 | - 7 | 45.5 | -10 | 32.0 | -15 | 28.3 | -11 | 26.7 | - 7 | 54.8 | -11 | 32.0 | -22 | 125.0 | -13 | 21.3 | - 7 | 22.3 | -10 | 16.1 | -14 | 41.4 | -6 | 45.6 | - 9 | 23.4 |
| | 3 weeks | -10 | 45.1 | - 6 | 48.1 | -11 | 43.4 | -11 | 34.5 | -12 | 32.8 | -10 | 43.3 | -10 | 33.7 | -27 | 171.0 | -10 | 23.0 | - 8 | 38.0 | - 8 | 34.2 | - 8 | 21.0 | -5 | 30.8 | -10 | 22.5 |
| | 2 months | -12 | 51.6 | - 8 | 56.7 | -12 | 49.3 | -12 | 43.5 | -12 | 40.8 | -10 | 50.4 | -12 | 41.2 | -25 | 186.0 | -12 | 29.7 | - 8 | 50.0 | - 7 | 22.4 | - 4 | 10.9 | -4 | 16.9 | -12 | 30.3 |
| | 6 months | -12 | 51.1 | -10 | 54.9 | -11 | 50.9 | -16 | 45.6 | -14 | 43.3 | -11 | 50.9 | -12 | 42.5 | -34 | 201.4 | -11 | 26.4 | -10 | 52.0 | - 6 | 20.9 | - 6 | 9.1 | -3 | 15.2 | -11 | 30.0 |
| | 1 year | -11 | 48.8 | -10 | 50.0 | -11 | 47.5 | -13 | 45.1 | -11 | 41.2 | -10 | 49.0 | -12 | 42.8 | -30 | 195.3 | -11 | 26.4 | - 7 | 52.7 | - 6 | 25.6 | - 5 | 0.7 | -3 | 15.6 | - 9 | 28.8 |

[a]Test No. 8 ambient temperature .'% hydraulic fluid.
[b]Change in hardness (points, Shore A).
[c]Change in volume (percent).

TABLE A-9. VARIOUS MIXTURES OF SILICONE AND CONVENTIONAL FLUID AMBIENT TEMPERATURE

| Conditions[a] | Time | | Neoprene | | SBR (70 Duro) | | EPDM (RM69) | | Natural Rubber (60 Duro) | | | Neoprene | | SBR (70 Duro) | | EPDM (RM69) | | Natural Rubber (60 Duro) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | b | c | b | c | b | c | b | c | | b | c | b | c | b | c | b | c |
| Silicone Base | Sample 1 (top) | | | | | | | | | | | | | | | | | | |
| Fluid Code A | 4 weeks | | -10 | 14.1 | -11 | 15.8 | -6 | 6.36 | -7 | 14.5 | | -10 | 12.1 | -10 | 13.5 | -6 | 5.14 | -7 | 12.1 |
| | 8 weeks | | - 9 | 15.3 | -11 | 15.7 | -6 | 6.82 | -7 | 15.3 | | - 9 | 14.4 | -10 | 14.3 | -7 | 6.10 | -8 | 13.2 |
| | 6 months | 5% | -10 | 17.0 | -11 | 15.2 | -6 | 6.68 | -7 | 14.1 | 10% | -10 | 14.7 | -10 | 13.4 | -6 | 5.81 | -7 | 12.0 |
| | 1 year | | -12 | 15.5 | -10 | 13.3 | -7 | 7.16 | -8 | 14.7 | | -11 | 13.0 | - 9 | 12.6 | -8 | 6.66 | -9 | 12.9 |
| | Sample 2 (bot) | | | | | | | | | | | | | | | | | | |
| | 4 weeks | | -11 | 16.7 | -11 | 15.0 | -6 | 5.86 | -8 | 13.3 | | -13 | 18.4 | - 9 | 13.3 | -6 | 5.34 | -7 | 11.2 |
| | 8 weeks | | -10 | 16.6 | -11 | 15.6 | -6 | 6.72 | -7 | 14.8 | | -10 | 17.3 | - 8 | 14.5 | -7 | 8.97 | -8 | 12.7 |
| | 6 months | | -10 | 18.4 | -11 | 15.5 | -7 | 6.66 | -7 | 14.0 | | -10 | 15.9 | -10 | 13.7 | -5 | 6.36 | -7 | 11.8 |
| | 1 year | | -12 | 15.2 | -10 | 13.7 | -7 | 7.10 | -8 | 14.1 | | -11 | 12.9 | - 9 | 12.5 | -8 | 7.10 | -8 | 13.3 |
| | Sample 1 (top) | | | | | | | | | | | | | | | | | | |
| | 4 weeks | | - 9 | 9.74 | -10 | 11.6 | -7 | 3.79 | -5 | 10.3 | | -10 | 10.4 | - 9 | 10.5 | -6 | 4.02 | -4 | 7.80 |
| | 8 weeks | | - 7 | 11.9 | - 8 | 12.2 | -7 | 4.91 | -6 | 11.2 | | - 7 | 12.0 | - 8 | 10.9 | -6 | 5.11 | -5 | 8.35 |
| | 6 months | 20% | - 8 | 11.8 | - 8 | 11.7 | -6 | 5.41 | -6 | 10.6 | 30% | - 8 | 10.2 | - 8 | 9.9 | -5 | 5.17 | -6 | 8.25 |
| | 1 year | | -10 | 9.0 | - 9 | 10.8 | -7 | 5.50 | -7 | 11.4 | | - 9 | 7.2 | - 8 | 9.1 | -6 | 6.60 | -6 | 8.90 |
| | Sample 2 (bot) | | | | | | | | | | | | | | | | | | |
| | 4 weeks | | -11 | 14.8 | - 9 | 11.2 | -6 | 3.84 | -6 | 9.01 | | -11 | 14.0 | - 8 | 9.63 | -6 | 3.77 | -5 | 6.96 |
| | 8 weeks | | - 9 | 14.2 | - 8 | 12.3 | -6 | 4.91 | -6 | 9.86 | | - 9 | 12.8 | - 8 | 10.00 | -6 | 4.81 | -3 | 7.61 |
| | 6 months | | - 9 | 11.4 | - 9 | 11.6 | -6 | 5.15 | -6 | 9.88 | | - 8 | 9.2 | - 8 | 9.54 | -5 | 5.51 | -5 | 7.78 |
| | 1 year | | -10 | 8.6 | - 9 | 10.8 | -7 | 5.40 | -8 | 10.90 | | - 9 | 6.9 | - 8 | 8.60 | -6 | 5.60 | -5 | 8.87 |
| Silicone Base | Sample 1 (top) | | | | | | | | | | | | | | | | | | |
| Fluid Code B | 4 weeks | | - 9 | 12.2 | - 9 | 13.5 | -3 | 5.10 | -8 | 13.6 | | - 9 | 9.82 | -10 | 12.2 | -5 | 3.97 | -6 | 9.03 |
| | 8 weeks | | - 8 | 13.7 | -10 | 13.6 | -5 | 5.54 | -7 | 14.6 | | - 8 | 12.4 | - 9 | 12.6 | -6 | 4.74 | -6 | 10.5 |
| | 6 months | 5% | -10 | 16.2 | - 9 | 13.1 | -6 | 5.13 | -7 | 13.6 | 10% | - 9 | 12.8 | -10 | 11.6 | -5 | 4.49 | -5 | 9.80 |
| | 1 year | | -10 | 14.1 | -10 | 11.3 | -7 | 5.80 | -8 | 14.0 | | -10 | 9.4 | -10 | 11.1 | -6 | 4.50 | -5 | 11.80 |
| | Sample 2 (bot) | | | | | | | | | | | | | | | | | | |
| | 4 weeks | | -10 | 15.6 | - 8 | 13.2 | -5 | 4.99 | -7 | 11.4 | | -12 | 15.2 | - 8 | 11.4 | -6 | 4.38 | -7 | 9.74 |
| | 8 weeks | | -10 | 15.5 | -10 | 13.7 | -6 | 5.80 | -5 | 12.3 | | -10 | 14.3 | -10 | 12.3 | -5 | 4.94 | -5 | 10.8 |
| | 6 months | | -11 | 16.6 | -10 | 13.0 | -5 | 5.54 | -6 | 11.7 | | -10 | 13.0 | -10 | 11.1 | -6 | 4.66 | -5 | 10.0 |
| | 1 year | | -10 | 12.5 | -10 | 11.2 | -6 | 4.90 | -8 | 12.3 | | -10 | 10.0 | - 8 | 10.5 | -7 | 5.20 | -8 | 11.0 |
| | Sample 1 (top) | | | | | | | | | | | | | | | | | | |
| | 4 weeks | | - 9 | 8.84 | - 8 | 8.90 | -6 | 3.18 | -6 | 7.66 | | - 8 | 8.75 | - 7 | 7.63 | -5 | 2.71 | -4 | 6.21 |
| | 8 weeks | | - 8 | 9.79 | - 8 | 8.95 | -5 | 3.74 | -4 | 8.72 | | - 5 | 7.89 | - 8 | 8.26 | -5 | 3.24 | -3 | 6.99 |
| | 6 months | 20% | - 7 | 9.50 | - 8 | 8.75 | -6 | 3.91 | -6 | 8.45 | 30% | - 7 | 7.78 | - 8 | 7.56 | -6 | 3.23 | -4 | 6.63 |
| | 1 year | | - 9 | 7.20 | - 7 | 7.60 | -6 | 1.80 | -7 | 5.50 | | - 8 | 5.01 | - 8 | 5.90 | -7 | 3.80 | -7 | 6.90 |

See footnotes on following page.

TABLE A-9 (CONT'D)

| Conditions[a] | Time | Neoprene | | SBR (70 Duro) | | EPDM (RM69) | | Natural Rubber (60 Duro) | | Neoprene | | SBR (70 Duro) | | EPDM (RM69) | | Natural Rubber (60 Duro) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sample 2 (bot) | | | | | | | | | | | | | | | | |
| | 4 weeks | -10 | 15.1 | - 7 | 9.29 | -5 | 4.39 | -5 | 5.99 | -10 | 12.5 | - 8 | 8.39 | -6 | 2.68 | -3 | 5.53 |
| | 8 weeks | -12 | 12.4 | - 7 | 9.71 | -4 | 5.37 | -4 | 7.51 | - 8 | 10.6 | - 7 | 8.59 | -6 | 3.26 | -3 | 6.01 |
| | 6 months | - 8 | 9.3 | - 9 | 8.98 | -5 | 3.52 | -6 | 7.92 | - 5 | 7.0 | - 8 | 7.47 | -7 | 3.20 | -4 | 6.20 |
| | 1 year | - 9 | 6.7 | - 7 | 8.00 | -6 | 6.14 | -7 | 8.80 | - 8 | 4.4 | - 7 | 6.70 | -7 | 3.30 | -6 | 6.90 |

[a]Test No. 9 ambient temperature silicone fluids with 5, 10, 20, 30% conventional fluid.
[b]Change in hardness (points, Shore D).
[c]Change in volume (percent).

TABLE A-10. NEOPRENE TESTS AT 212° F

| Conditions[a] | Time | Neoprene | |
|---|---|---|---|
| | | [b] - | [c] - |
| Silicone Base | Sample 1 | | |
| Compatibility | 3 days | - 2 | 3.56 |
| Fluid (RM70) | 7 days | - 3 | 9.43 |
| | Sample 2 | | |
| | 3 days | - 3 | 7.47 |
| | 7 days | - 3 | 16.1 |
| Conventional | Sample 1 | | |
| Compatibility | 3 days | - 7 | 17.2 |
| Fluid | 7 days | -18 | 21.9 |
| (RM66-06) | Sample 2 | | |
| | 3 days | - 8 | 16.4 |
| | 7 days | -18 | 21.2 |
| Silicone Base | Sample 1 | | |
| Fluid Code A | 3 days | ± 0 | 1.79 |
| | 7 days | ± 0 | 6.86 |
| | Sample 2 | | |
| | 3 days | ± 0 | 4.00 |
| | 7 days | ± 3 | 12.9 |
| Silicone Base | Sample 1 | | |
| Fluid Code B | 3 days | ± 0 | 1.57 |
| | 7 days | ± 2 | 5.45 |
| | Sample 2 | | |
| | 3 days | ± 2 | 0.142 |
| | 7 days | ± 6 | 4.67 |
| Silicone Base | Sample 1 | | |
| Fluid Code C | 3 days | - 7 | 4.93 |
| | 7 days | - 7 | 10.7 |
| | Sample 2 | | |
| | 3 days | -11 | 8.35 |
| | 7 days | -10 | 14.1 |

[a]Test No. 10 neoprene rubber at 212° F.
[b]Change in hardness (points, Shore D).
[c]Change in volume (percent).

TABLE A-11. CONTAMINATED FLUIDS (WATER)

| Conditions[a] | Time | Neoprene | | SBR (70 Duro) | | EPDM RM69 | | Natural Rubber (60 Duro) | |
|---|---|---|---|---|---|---|---|---|---|
| | | b | c | b | c | b | c | b | c |
| Test 11 | Sample 1 | | | | | | | | |
| Silicone Base | 3 days | -1 | 2.03 | -5 | 9.55 | -4 | 6.30 | -4 | 9.95 |
| Compatibility | 7 days | -3 | 1.77 | -7 | 9.84 | -2 | 5.86 | -5 | 9.77 |
| Fluid (RM70) | Sample 2 | | | | | | | | |
| | 3 days | -1 | 2.21 | -5 | 9.48 | -4 | 6.55 | -4 | 9.05 |
| | 7 days | -3 | 1.19 | -7 | 9.88 | -2 | 5.88 | -5 | 9.27 |
| Conventional | Sample 1 | | | | | | | | |
| Compatibility | 3 days | -7 | 10.50 | -4 | 4.24 | -2 | 0.78 | -1 | 1.35 |
| Fluid (RM66-06) | 7 days | -7 | 9.60 | -3 | 1.83 | -2 | 0.60 | -4 | 1.62 |
| | Sample 2 | | | | | | | | |
| | 3 days | -7 | 10.10 | -4 | 4.31 | -2 | 1.40 | -1 | 1.24 |
| | 7 days | -7 | 9.07 | -3 | 2.14 | -2 | 0.99 | -4 | 1.77 |
| Silicone Fluid | Sample 1 | | | | | | | | |
| Code A | 3 days | -1 | 0.34 | -7 | 6.69 | -5 | 7.44 | -5 | 11.59 |
| | 7 days | +3 | 0.16 | -6 | 6.56 | -5 | 8.03 | -9 | 12.80 |
| | Sample 2 | | | | | | | | |
| | 3 days | -1 | 0.39 | -7 | 8.50 | -5 | 8.87 | -5 | 11.32 |
| | 7 days | +3 | 0.16 | -6 | 8.38 | -5 | 8.01 | -9 | 12.30 |
| Silicone Fluid | Sample 1 | | | | | | | | |
| Code B | 3 days | -2 | 0.49 | -5 | 6.58 | -3 | 5.53 | -6 | 8.40 |
| | 7 days | ±0 | 0.09 | -5 | 8.33 | -2 | 5.68 | -7 | 10.80 |
| | Sample 2 | | | | | | | | |
| | 3 days | -2 | 0.88 | -5 | 6.99 | -3 | 5.69 | -5 | 8.37 |
| | 7 days | ±0 | 0.48 | -5 | 7.84 | -2 | 5.72 | -5 | 9.01 |
| Silicone Fluid | Sample 1 | | | | | | | | |
| Code C | 3 days | -2 | 4.20 | -7 | 10.00 | -5 | 7.44 | -5 | 11.59 |
| | 7 days | -2 | 4.24 | -6 | 9.88 | -5 | 8.03 | -9 | 12.80 |
| | Sample 2 | | | | | | | | |
| | 3 days | -2 | 3.17 | -7 | 9.49 | -5 | 8.87 | -5 | 11.32 |
| | 7 days | -2 | 3.88 | -6 | 9.64 | -5 | 8.01 | -9 | 12.25 |

See footnotes at end of table.

TABLE A-11 (CONT'D)

| Conditions[a] | Time | Neoprene | | SBR (70 Duro) | | EPDM RM69 | | Natural Rubber (60 Duro) | |
|---|---|---|---|---|---|---|---|---|---|
| | | b | c | b | c | b | c | b | c |
| Test 11A | Sample 1 | | | | | | | | |
| Silicone Base | 3 days | - 2 | 2.69 | + 5 | 8.62 | - 8 | 5.13 | -27 | 9.30 |
| Compatibility | 7 days | + 5 | 17.2 | + 2 | 19.80 | - 8 | 9.02 | -19 | 17.80 |
| Fluid (RM70) | Sample 2 | | | | | | | | |
| | 3 days | - 2 | 4.87 | + 5 | 9.71 | - 8 | 9.32 | -27 | 11.46 |
| | 7 days | + 5 | 14.9 | + 2 | 20.20 | - 8 | 12.92 | -19 | 16.44 |
| Conventional | Sample 1 | | | | | | | | |
| Compatibility | 3 days | -12 | 17.60 | - 4 | 7.01 | - 5 | 1.15 | -10 | 3.15 |
| Fluid (RM66-06) | 7 days | -13 | 18.09 | - 8 | 7.63 | - 5 | 1.95 | - 9 | 4.07 |
| | Sample 2 | | | | | | | | |
| | 3 days | -12 | 16.66 | - 4 | 8.05 | - 5 | 0.76 | -10 | 2.66 |
| | 7 days | -13 | 18.25 | - 8 | 8.04 | - 5 | 1.61 | - 9 | 3.62 |
| Silicone Fluid | Sample 1 | | | | | | | | |
| Code A | 3 days | ± 0 | -1.23 | - 5 | 6.08 | - 4 | 5.83 | - 7 | 6.20 |
| | 7 days | + 4 | -3.02 | - 5 | 4.90 | - 7 | 6.45 | -10 | 5.97 |
| | Sample 2 | | | | | | | | |
| | 3 days | ± 0 | -1.87 | - 5 | 7.03 | - 4 | 6.19 | - 7 | 4.99 |
| | 7 days | + 4 | -3.33 | - 5 | 6.00 | - 7 | 7.50 | -10 | 6.65 |
| Silicone Fluid | Sample 1 | | | | | | | | |
| Code B | 3 days | + 1 | -1.69 | - 6 | 7.16 | - 3 | 3.96 | - 9 | 7.59 |
| | 7 days | + 1 | -5.39 | - 6 | 5.21 | - 5 | 5.11 | -11 | 6.41 |
| | Sample 2 | | | | | | | | |
| | 3 days | + 1 | -1.56 | - 6 | 7.30 | - 3 | 7.43 | - 9 | 8.42 |
| | 7 days | + 1 | -6.80 | - 6 | 4.51 | - 5 | 7.70 | -11 | 7.66 |
| Silicone Fluid | Sample 1 | | | | | | | | |
| Code C | 3 days | - 3 | 2.98 | - 8 | 9.55 | - 6 | 7.49 | -20 | 12.59 |
| | 7 days | - 5 | 7.24 | -12 | 10.20 | - 8 | 10.14 | -33 | 14.48 |
| | Sample 2 | | | | | | | (disintegrated) | |
| | 3 days | - 3 | 3.61 | - 8 | 9.99 | - 6 | 7.71 | -20 | 12.60 |
| | 7 days | - 5 | 6.77 | -12 | 11.43 | - 8 | 10.48 | -33 | 15.06 |
| | | | | | | | | (disintegrated) | |

[a]Test 11, 70° C, 3.5% water; test 11 A, 120° C, 3.5% water.
[b]Change in hardness (points, Shore D).
[c]Change in volume (percent).

TABLE A-12. PRESOAKED IN CONVENTIONAL FLUID

| Conditions[a] | Time | EPDM (70 Duro) | | EPDM (80 Duro) | | Natural Rubber | | SBR (50 Duro) | | SBR (70 Duro) | | SBR (SAE) | | Neoprene | | Natural Rubber | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | b | c | b | c | b | c | b | c | b | c | b | c | b | c | b | c |
| Test No. 12 Silicone Compatibility Fluid (RM70) | Sample 1 7 days | -6 | 6.35 | -5 | 7.65 | -6 | 12.80 | -8 | 9.32 | -7 | 10.00 | -5 | 10.4 | -10 | 3.67 | -3 | 0.54 |
| | Sample 2 7 days | -5 | 5.82 | -4 | 7.03 | -7 | 8.96 | -8 | 9.22 | -6 | 9.09 | -5 | 10.3 | -10 | 4.25 | -2 | 0.55 |
| Silicone Fluid Code A | Sample 1 7 days | -4 | 4.97 | -5 | 4.99 | -5 | 6.6[illegible] | -6 | 8.07 | -6 | 10.60 | -5 | 9.57 | -11 | 4.29 | -1 | 0.34 |
| | Sample 2 7 days | -4 | 5.30 | -3 | 4.52 | -6 | 7.47 | -6 | 9.05 | -7 | 8.82 | -6 | 11.50 | -12 | 5.97 | -1 | 0.30 |
| Silicone Fluid Code B | Sample 1 7 days | -5 | 3.21 | -2 | 3.96 | -5 | 6.64 | -6 | 8.46 | -5 | 8.06 | -5 | 9.65 | -11 | 3.57 | -2 | 0.45 |
| | Sample 2 7 days | -5 | 4.56 | -3 | 4.48 | -5 | 5.94 | -6 | 8.49 | -5 | 7.97 | -5 | 8.93 | -11 | 6.87 | ±0 | 0.46 |
| Silicone Fluid Code C | Sample 1 7 days | -5 | 6.35 | -6 | 5.48 | -9 | 12.10 | -9 | 12.70 | -8 | 12.70 | -7 | 13.60 | -15 | 8.60 | -2 | 1.19 |
| | Sample 2 7 days | -5 | 6.47 | -5 | 5.20 | -8 | 12.10 | -9 | 12.10 | -8 | 11.60 | -7 | 13.00 | -12 | 8.45 | ±0 | 1.09 |

[a]Test 12, presoaked at 70° C for 72 hours in conventional compatibility fluid RM 66-06, exposed at 70° C in silicone fluids for 7 days.
[b]Change in hardness (points, Shore D).
[c]Change in volume (percent).

## APPENDIX B - REFERENCES


1. Authority: TECOM Task No. 7-CO-IL8-AP1-001, Agency Accession No. DA OM 1499, ILIR Work Unit 001 K2 02.

2. MERDC Report No. 2137, Silicone Brake Fluids: One Year Field Test, February 1975 (AD AO 12849).

3. MERADCOM Report No. 2164, Silicone Brake Fluids: Two Year Field Test, January 1976 (AD OZ 6180).

4. Military Specification, MIL-B-46176, Brake Fluid Silicone, Automotive, All-Weather, Operational and Preservative.

5. Federal Specification, VV-B-680, Brake Fluid Automotive.

6. Military Specification, MIL-H-13910, Hydraulic Fluid, Polar Type, Automotive Brake, All Weather.

7. Military Specification, MIL-P-46046, Preservative Fluid, Automotive Brake System and Components.

8 MTD Report APG-MT-5351, Partial Report Compatibility of Silicone-Based Brake Fluids with Elastomeric Components of Army Vehicles and Weapons Systems, February 1980.

9. Military Specification, MIL-L-2104, Lubricating Oil, Internal Combustion Engine (Heavy Duty).

10. Military Specification, MIL-L-46167, Lubricating Oil, Internal Combustion Engine, Artic.

11. Military Specification, MIL-H-6083, Hydraulic Fluid Petroleum Base, for Preservation and Operation.




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